TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
5N 157B Lookout Place

APR 25 1990

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) - ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

In accordance with Technical Specifications 6.9.1.6 and 6.9.1.7 for SQN Units 1 and 2, enclosed is the Annual Radiological Environmental Operating Report for 1989.

No commitments are contained in this submittal. Please direct questions concerning this issue to Kathy S. Whitaker at (615) 843-7748.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

E. G. Wallace, Manager
Nuclear Licensing and
Regulatory Affairs

Enclosure
cc (Enclosure):
Ms. S. C. Black, Assistant Director
for Projects
TVA Projects Division
U.S. Nuclear Regulatory Commission
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852

NRC Resident Inspector
Sequoyah Nuclear Plant
2600 Igou Ferry Road
Soddy Daisy, Tennessee 37379

Mr. B. A. Wilson, Assistant Director
for Inspection Programs
TVA Projects Division
U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

TENNESSEE VALLEY AUTHORITY

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT
SEQUOYAH NUCLEAR PLANT
1989

CHEMISTRY AND RADIOLOGICAL SERVICES

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

SEQUOYAH NUCLEAR PLANT

1989

TENNESSEE VALLEY AUTHORITY

NUCLEAR ASSURANCE AND SERVICES

CHEMISTRY AND RADIOLOGICAL SERVICES

April 1990

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

This report describes the environmental radiological monitoring program conducted by TVA in the vicinity of the Sequoyah Nuclear Plant (SQN) in 1989. The program includes the collection of samples from the environment and the determination of the concentrations of radioactive materials in the samples. Samples are taken from stations in the general area of the plant and from areas not influenced by plant operations. Station locations are selected after careful consideration of the weather patterns and projected radiation doses to the various areas around the plant. Material sampled includes air, water, milk, foods, vegetation, soil, fish, sediment, and direct radiation levels. Results from stations near the plant are compared with concentrations from control stations and with preoperational measurements to determine potential impacts of plant operations.

The vast majority of the exposures calculated from environmental samples were contributed by naturally occurring radioactive materials or from materials commonly found in the environment as a result of atmospheric nuclear weapons fallout. Small amounts of Co-60 were found in sediment samples downstream from the plant. This activity in river sediment would result in no measurable increase over background in the dose to the general public.

INTRODUCTION

This report describes and summarizes a huge volume of data, the results of many thousands of measurements and laboratory analyses. The measurements are made to comply with regulations and to determine potential effects on public health and safety. This report satisfies the annual reporting requirements of SQN Technical Specification 6.9.1.6. In addition, estimates of the maximum potential doses to the surrounding population are made from radioactivity measured both in plant effluents and in environmental samples. Some of the data presented are prescribed by specific requirements while other data are included which may be useful or interesting to individuals who do not work with this material routinely.

Naturally Occurring and Background Radioactivity

All materials in our world contain trace amounts of naturally occurring radioactivity. Approximately 0.01 percent of all potassium is radioactive potassium-40. Potassium-40 (K-40), with a half-life of 1.3 billion years, is one of the major types of radioactive materials found naturally in our environment. An individual weighing 150 pounds contains about 140 grams of potassium (reference 1). This is equivalent to approximately 100,000 pCi of K-40 which delivers a dose of 15 to 20 mrem per year to the bone and soft tissue of the body. Naturally occurring radioactive materials have always been in our environment. Other examples of naturally occurring radioactive materials are bismuth-212 and 214, lead-212 and 214, thallium 208, actinium-228, uraninum-238, uranium-235, thorium-234, radium-226, radon-222, carbon-14, and hydrogen-3 (generally called tritium).

These naturally occurring radioactive materials are in the soil, our food, our drinking water, and our bodies. The radiation from these materials makes up a part of the low-level natural background radiation. The remainder of the natural background radiation comes from outer space. We are all exposed to this natural radiation 24 hours per day.

The average dose equivalent at sea level resulting from radiation from outer space (part of natural background radiation) is about 27 mrem/year. This essentially doubles with each 6600-foot increase in altitude in the lower atmosphere. Another part of natural background radiation comes from naturally occurring radioactive materials in the soil and rocks. Because the quantity of naturally occurring radioactive material varies according to geographical location, the part of the natural background radiation coming from this radioactive material also depends upon the geographical location. Most of the remainder of the natural background radiation comes from the radioactive materials within each individual's body. We absorb these materials from the food we eat which contains naturally occurring radioactive materials from the soil. An example of this is K-40 as described above. Even building materials affect the natural background radiation levels in the environment. Living or working in a building which is largely made of earthen material, such as concrete or brick, will generally result in a higher natural background radiation level than would exist if the same structure were made of wood. This is due to the naturally occurring radioisotopes in the concrete or brick, such as trace amounts of uranium, radium, thorium, etc.

Because the city of Denver, Colorado, is over 5000 feet in altitude and the soil and rocks there contain more radioactive material than the U.S. average, the people of Denver receive around 350 mrem/year total natural background radiation dose equivalent compared to about 295 mrem/year for the national average. People in some locations of the world receive over 1000 mrem/year natural background radiation dose equivalent, primarily because of the greater quantity of radioactive materials in the soil and rocks in those locations. Scientists have never been able to show that these levels of radiation have caused physical harm to anyone.

It is possible to get an idea of the relative hazard of different types of radiation sources by evaluating the amount of radiation the U.S. population receives from each general type of radiation source. The information below is primarily adapted from references 2 and 3.

U.S. GENERAL POPULATION AVERAGE DOSE EQUIVALENT ESTIMATES

Source	Millirem/Year Per Person	
Natural background dose equivalent		
Cosmic	27	
Cosmogenic	1	
Terrestrial	28	
In the body	39	
Radon	200	
Total		295
Release of radioactive material in natural gas, mining, milling, etc.		5
Medical (effective dose equivalent)		53
Nuclear weapons fallout		less than 1
Nuclear energy		0.28
Consumer products		0.03
Total		355 (approximately)

As can be seen from the table, natural background radiation dose equivalent to the U.S. population normally exceeds that from nuclear plants by several hundred times. This indicates that nuclear plant operations normally result in a population radiation dose equivalent which is insignificant compared to that which results from natural background radiation. It should be noted that the use of radiation and radioactive materials for medical uses has resulted in a similar effective dose equivalent to the U.S. population as that caused by natural background radiation.

Significant discussion recently has centered around exposures from radon. Radon is an inert gas given off as a result of the decay of naturally occurring radium-226 in soil. When dispersed in the atmosphere, radon concentrations are relatively low. However, when the gas is trapped in closed spaces, it can build up until concentrations become significant. The National Council of Radiation Protection and Measurements (reference 2) has estimated that the average annual effective dose equivalent from radon in the United States is approximately 200 mrem/year. This estimated dose is approximately twice the average dose equivalent from all other natural background sources.

Electric Power Production

Nuclear power plants are similar in many respects to conventional coal burning (or other fossil fuel) electrical generating plants. The basic process behind electrical power production in both types of plants is that fuel is used to heat water to produce steam.

However, nuclear plants require many complex systems to control the nuclear fission process and to safeguard against the possibility of reactor malfunction, which could lead to the release of radioactive materials. Very small amounts of these "fission and activation products" are released into the plant systems. This radioactive material can be transported throughout plant systems and some of it released to the environment.

All paths through which radioactivity is released are monitored. Liquid and gaseous effluent monitors record the radiation levels for each release. These monitors also provide alarming mechanisms to allow for termination of any release above limits.

Releases are monitored at the onsite points of release and through an environmental monitoring program which measures the environmental radiation in outlying areas around the plant. In this way, not only is the release of radioactive materials from the plant tightly controlled, but measurements are made in surrounding areas to ensure that the population is not being exposed to significant levels of radiation or radioactive materials.

Plant Technical Specifications limit the release of radioactive effluents, as well as offsite doses due to the release of these effluents. Additional limits are set by the Environmental Protection Agency (EPA) for doses to the public.

The doses to a member of the general public from radioactive materials released to unrestricted areas, as given in the Technical Specifications, are limited to the following:

Liquid Effluents

Total body	≤3 mrem/year
Any organ	≤10 mrem/year

Gaseous Effluents

Noble gases:

Gamma radiation	≤10 mrad/year
Beta radiation	≤20 mrad/year

Particulates:

Any organ	≤15 mrem/year

The EPA limits for the total dose to the public in the vicinity of a nuclear power plant, established in the Environmental Dose Standard of 40 CFR 190, are as follows.

Total body	25 mrem/year
Thyroid	75 mrem/year
Any other organ	25 mrem/year

In addition, 10 CFR 20.106 provides maximum permissible concentrations (MPCs) for radioactive materials released to unrestricted areas. MPCs for the principal radionuclides associated with nuclear power plant effluents are presented in table 1.

SITE/PLANT DESCRIPTION

The SQN is located on a site near the geographical center of Hamilton County, Tennessee, on a peninsula on the western shore of Chickamauga Lake at Tennessee River Mile (TRM) 484.5. Figure 1 shows the site in relation to other TVA projects. The SQN site, containing approximately 525 acres, is approximately 7.5 miles northeast of the nearest city limit of Chattanooga, Tennessee, 14 miles west-northwest of Cleveland, Tennessee, and approximately 31 miles south-southwest of TVA's Watts Bar Nuclear Plant (WBN) site.

Population is distributed rather unevenly within 10 miles of the SQN site. Approximately 60 percent of the population is in the general area between 5 and 10 miles from the plant in the sectors ranging from the SSW, clockwise, to the NW sector. This concentration is a reflection of suburban Chattanooga and the town of Soddy-Daisy. This area is characterized by considerable vacant land with scattered high quality residential subdivisions. The northern extent of the residential development is approximately 2 miles from the site. The population of the Chattanooga urbanized area is over 250,000, while Soddy-Daisy has approximately 10,000 people.

With the exception of the community of Soddy-Daisy, the areas west, north, and east of the plant are sparsely settled. Development consists of scattered semirural and rural dwellings with associated small-scale farming. At least one dairy farm is located within a 10-mile radius of the plant.

Chickamauga Reservoir is one of a series of highly controlled multiple-use reservoirs whose primary uses are flood control, navigation, and the generation of electric power. Secondary uses include industrial and public water supply and waste disposal, commercial fishing, and recreation. Public access areas, boat docks, and residential subdivisions have been developed along the reservoir shoreline.

The SQN consists of two pressurized water reactors: each unit is rated at 1171 megawatts (electrical). Fuel was loaded in unit 1 on March 1, 1980, and the unit achieved critically on July 5, 1980. Fuel was loaded in unit 2 in July 1981, and the unit achieved initial criticality on November 5, 1981. The plant, shut down in August 1985, was restarted in 1988.

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

The unique environmental concern associated with a nuclear power plant is its production of radioactive materials and radiation. The vast majority of this radiation and radioactivity is contained within the reactor itself or one of the other plant systems designed to keep the material in the plant. The retention of the materials in each level of control is achieved by system engineering, design, construction, and operation. Environmental monitoring is a final verification that the systems are performing as planned. The monitoring program is designed to check the pathways between the plant and the people in the immediate vicinity and to most efficiently monitor these pathways. Sample types are chosen so that the potential for detection of radioactivity in the environment will be maximized. The environmental radiological monitoring program is outlined in appendix A.

There are two primary pathways by which radioactivity can move through the environment to humans: air and water (see figure 2). The air pathway can be separated into two components: the direct (airborne) pathway and the indirect (ground or terrestrial) pathway. The direct airborne pathway consists of direct radiation and inhalation by humans. In the terrestrial pathway, radioactive materials may be deposited on the ground or on plants and subsequently be ingested by animals and/or humans. Human exposure through the liquid pathway may result from drinking water, eating fish, or by direct exposure at the shoreline. The types of samples collected in this program are designed to monitor these pathways.

A number of factors were considered in determining the locations for collecting environmental samples. The locations for the atmospheric monitoring stations were determined from a critical pathway analysis based on weather patterns, dose projections, population distribution, and land use. Terrestrial sampling stations were selected after reviewing such things as the locations of dairy animals and gardens in conjuction with the air pathway analysis. Liquid pathway stations were selected based on dose projections, water use information, and availability of media such as fish and sediment. Table A-2 lists the sampling stations and the types of samples collected from each. Modifications made to the program in 1989 are described in appendix B and exceptions to the sampling and analysis schedule are presented in appendix C. To determine the amount of radioactivity in the environment prior to the operation of SQN, a preoperational environmental radiological monitoring program was initiated in 1971 and operated until the plant began operation in 1980. Measurements of the same types of radioactive materials that are measured currently were assessed during the preoperational phase to establish normal background levels for various radionuclides in the environment. This is very important in that during the 1950s, 60s, and 70s, atmospheric nuclear weapons testing occurred which released radioactive material to the environment causing fluctuations in the natural background radiation levels. This radioactive material is the same type as that produced in the SQN reactors. Preoperational knowledge of natural radionuclide patterns in the environment permits a determination, through comparison and trending analyses, of whether the operation of SQN is impacting the environment and thus the surrounding population. The determination of impact during the operating phase also considers the presence of control stations that have been established in the environment. Results of environmental samples taken at control stations (far from the plant) are compared with those from indicator stations (near the plant) to establish the extent of SQN influence.

All samples are analyzed by the radioanalytical laboratory of TVA's Environmental Radiological Monitoring and Instrumentation Department located at the Western Area Radiological Laboratory (WARL) in Muscle Shoals, Alabama. All analyses are conducted in accordance with written and approved procedures and are based on accepted methods. A summary of the analysis techniques and methodology is presented in appendix D. Data tables summarizing the sample analysis results are presented in appendix H.

The sophisticated radiation detection devices used to determine the radionuclide content of samples collected in the environment are generally quite sensitive to small amounts of radioactivity. In the field of radiation measurement, the sensitivity of the measurement process is discussed in terms of the lower limit of detection (LLD). A description of the nominal LLDs for the radioanalytical laboratory is presented in appendix E.

The radioanalytical laboratory employs a comprehensive quality assurance/ quality control program to monitor laboratory performance throughout the year. The program is intended to detect any problems in the measurement process as soon as possible so they can be corrected. This program includes equipment checks to ensure that the complex radiation detection devices are working properly and the analysis of special samples which are included alongside routine environmental samples. A complete description of the program is presented in appendix F.

DIRECT RADIATION MONITORING

Direct radiation levels are measured at a number of stations around the plant site. These measurements include contributions from cosmic radiation, radioactivity in the ground, fallout from atmospheric nuclear weapons tests conducted in the past, and any radioactivity that may be present as a result of plant operations. Because of the relatively large variations in background radiation as compared to the small levels from the plant, contributions from the plant may be difficult to distinguish.

Radiation levels measured in the area around the SQN site in 1989 were consistent with levels from previous years and with levels measured at other locations in the region.

Measurement Techniques

Direct radiation measurements are made with thermoluminescent dosimeters (TLDs). When certain materials are exposed to ionizing radiation, many of the electrons which become displaced are trapped in the crystalline structure of the material. When the material is heated, the electrons are released, along with a pulse of light. A measurement of the intensity of the light is directly proportional to the radiation to which the material was exposed. Materials which display these characteristics are used in the manufacture of TLDs.

Since 1971 TVA has used a manganese activated calcium fluoride ($Ca_2F:Mn$) TLD material encased in a glass bulb. The bulb is placed in an energy compensating shield to correct for energy dependence of the material.

TLDs are placed approximately 1 meter above the ground, with three TLDs at each station. Twenty-two stations are located around the plant near the site boundary, at least one station in each of the 16 sectors. Dosimeters are also placed at the perimeter and remote air monitoring sites and at 22 additional stations out to approximately 10 miles from the site. The TLDs are exchanged every 3 months and read with a Victoreen model 2810 TLD reader. The values are corrected for gamma response, self-irradiation, and fading, with individual gamma response calibrations and self-irradiation factors determined for each TLD. The system meets or exceeds the performance specifications outlined in Regulatory Guide 4.13 for environmental applications of TLDs.

In 1989, TVA began the process of changing from the Victoreen dosimeter to the Panasonic Model UD-814 dosimeter. This dosimeter contains four elements consisting of one lithium borate and three calcium sulfate phosphors. The calcium sulfate phosphors are shielded by approximately 1000 mg/cm^2 plastic and lead to compensate for the over-response of the detector to low energy radiation. These dosimeters are deployed in the same manner as the bulb detectors described above. The accumulated exposure on the detectors is read with a Panasonic Model UD-710A automatic reader interfaced with a Hewlett Packard Model 9000 computer system. Since the calcium sulfate phosphor is much more sensitive that the lithium borate, the measured exposure is taken as the median of the results obtained from the nine calcium sulfate phosphors in three detectors. The values are corrected for gamma response, system variations, and transit exposure, with individual gamma response calibrations for each element. This system also meets or exceeds the performance specifications outlined in Regulatory Guide 4.13 for environmental applications of TLDs.

Results

For 1989, the results obtained with both the Victoreen and the Panasonic dosimeters are included in this report. All results are normalized to a standard quarter (91.25 days or 2190 hours). The stations are grouped according to the distance from the plant. The first group consists of all stations within 1 mile of the plant. The second group lies between 1 and 2 miles, the third group between 2 and 4 miles, the fourth between 4 and 6 miles, and the fifth group is made up of all stations greater than 6 miles from the plant. Past data have shown that the results from all stations greater than 2 miles from the plant are essentially the same. Therefore, for purposes of this report, all stations 2 miles or less from the plant are identified as "onsite" stations and all others are considered "offsite."

Prior to 1976, direct radiation measurements in the environment were made with less sensitive dosimeters. Consequently, environmental radiation levels reported in that phase of the preoperational monitoring program exceed current measurements of background radiation levels. For this reason, data collected prior to 1976 are not included in this report.

The quarterly gamma radiation levels determined from the TLDs deployed around SQN in 1989 are given in table H-1. The rounded average annual exposures are shown below. For comparison purposes, the average direct radiation measurements made in the preoperational phase of the monitoring program are also shown.

Annual Average Direct Radiation Levels SQN mR/year	1989 Victoreen	1989 Panasonic	Preoperational Average
Onsite Stations	70	59	79
Offsite Stations	61	51	63

The data in table H-1 indicate that the average quarterly radiation levels at the SQN onsite stations are approximately 2-3 mR/quarter higher than levels at the offsite stations. This difference is also noted in the preoperational phase and in the stations at WBN and other nonoperating TVA nuclear power plant construction sites where the average levels onsite are generally 2-6 mR/quarter higher than levels offsite. The causes of these differences have not been isolated; however, it is postulated that the differences are probably attributable to combinations of influences such as natural variations in environmental radiation levels, earth-moving activities onsite, and the mass of concrete employed in the construction of the plant. Other undetermined influences may also play a part.

Figure H-1 compares plots of the data from the onsite or site boundary stations with those from the offsite stations over the period from 1976 through 1989. To reduce the variations present in the data sets, a 4-quarter moving average was constructed for each data set. Figure H-2 presents a trend plot of the direct radiation levels as defined by the moving averages. The data follow the same general trend as the raw data, but the curves are smoothed considerably.

The procedures for the handling and readout of the Panasonic dosimeters and calculating the exposure from the raw data generated by the dosimeters were being developed during the year. The data from the Panasonic dosimeters vary with the exposures calculated from the Victoreen dosimeters by 6 to 20 percent.

All results reported in 1989 are consistent with direct radiation levels identified at locations which are not influenced by the operation of SQN. There is no indication that SQN operations increased the background radiation levels normally observed in the areas surrounding the plant.

ATMOSPHERIC MONITORING

The atmospheric monitoring network is divided into three groups identified as local, perimeter, and remote. Four local air monitoring stations are located on or adjacent to the plant site in the general areas of greatest wind frequency. Four perimeter air monitoring stations are located in communities out to about 10 miles from the plant, and four remote air monitors are located out to 20 miles. The monitoring program and the locations of monitoring stations are identified in the tables and figures of appendix A. The remote stations are used as control or baseline stations.

Results from the analysis of samples in the atmospheric pathway are presented in tables H-2 and H-3. Radioactivity levels identified in this reporting period are consistent with background and radionuclides produced as a result of fallout from previous nuclear weapons tests. There is no indication of an increase in atmospheric radioactivity as a result of SQN.

Sample Collection and Analysis

Air particulates are collected by continuously sampling air at a flow rate of approximately 2 cubic feet per minute (cfm) through a 2-inch Hollingsworth and Vose LB5211 glass fiber filter. The sampling system consists of a pump, a magnehelic gauge for measuring the drop in pressure across the system, and a dry gas meter. This allows an accurate determination of the volume of air passing through the filter. This system is housed in a building approximately 2 feet by 3 feet by 4 feet. The filter is contained in a sampling head mounted on the outside of the monitor building. The filter is replaced every 7 days.

Each filter is analyzed for gross beta activity about 3 days after collection to allow time for the radon daughters to decay. Every 4 weeks composites of the filters from each location are analyzed by gamma spectroscopy. On a quarterly basis, all of the filters from one location are composited and analyzed for Sr-89,90.

Gaseous radioiodine is collected using a commercially available cartridge containing TEDA-impregnated charcoal. This system is designed to collect iodine in both the elemental form and as organic compounds. The cartridge is located in the same sampling head as the air particulate filter and is downstream of the particulate filter. The cartridge is changed at the same time as the particulate filter and samples the same volume of air. Each cartridge is analyzed for I-131. If activity above a specified limit is detected, a complete gamma spectroscopy analysis is performed.

Rainwater is collected by use of a collection tray attached to the monitor building. The collection tray is protected from debris by a screen cover. As water drains from the tray, it is collected in one of two 5-gallon containers inside the monitor building. A 1-gallon sample is removed from the container every 4 weeks. Any excess water is discarded. Rainwater samples are held to be analyzed only if the air particulate samples indicate the presence of elevated activity levels or if fallout is expected. For example, rainwater samples were analyzed during the period of fallout following the accident at Chernobyl. No rainwater samples from SQN were analyzed in this reporting period.

Results

The results from the analysis of air particulate samples are summarized in table H-2. Gross beta activity in 1989 was consistent with levels reported in previous years. The average level at both indicator and control stations was 0.018 pCi/m^3. The annual averages of the gross beta activity in air particulate filters at these stations for the years 1971-1989 are presented in figure H-3. Increased levels due to fallout from atmospheric nuclear weapons testing are evident, especially in 1971, 1977, 1978, and 1981. Evidence of a small increase resulting from the Chernobyl accident can also be seen in 1986. These patterns are consistent with data from monitoring programs conducted by TVA at nonoperating nuclear power plant construction sites.

Only natural radioactive materials were identified by the monthly gamma spectral analysis of the air particulate samples. No fission or activation products were found at levels greater than the LLDs. As shown in table H-3, iodine-131 was detected in three charcoal canister samples at a level slightly higher than the nominal LLD. The highest levels reported are 0.022 and 0.023 pCi/m^3, respectively, for indicator and control stations. These levels are probably the result of interference from radon daughters in the samples.

TERRESTRIAL MONITORING

Terrestrial monitoring is accomplished by collecting samples of environmental media that may transport radioactive material from the atmosphere to humans. For example, radioactive material may be deposited on a vegetable garden and be ingested along with the vegetables or it may be deposited on pasture grass where dairy cattle are grazing. When the cow ingests the radioactive material, some of it is transferred to the milk and consumed by humans who drink the milk. Therefore, samples of milk, vegetation, soil, and food crops are collected and analyzed to determine potential impacts from exposure to this pathway. The results from the analysis of these samples are shown in tables H-4 through H-12.

A land use survey is conducted annually to locate milk producing animals and gardens within a 5-mile radius of the plant. Only one dairy farm is located in this area; however, three farms with at least one milk producing animal have been identified within 5 miles of the plant. The dairy and the farms are considered indicator stations and routinely provide milk or vegetation samples. The results of the 1989 land use survey are presented in appendix G.

Sample Collection and Analysis

Milk samples are purchased every 2 weeks from the dairy, from two of the farms within 5 miles of the plant, and from at least one of three control dairies. These samples are placed on ice for transport to the radioanalytical laboratory. A specific analysis for I-131 and a gamma spectral analysis are performed on each sample and Sr-89,90 analysis is performed every 4 weeks.

Samples of vegetation are collected every 4 weeks for I-131 analysis. For the first six months of the year, samples were collected from the same locations as milk samples and from selected air monitoring stations. Samples are currently collected from the farm with milk producing animals but insufficient milk to provide a sample, and from one control dairy farm. The samples are collected by cutting or breaking enough vegetation to provide between 100 and 200 grams of sample. Care is taken not to include any soil with the vegetation. The sample is placed in a container with 1650 ml of 0.5 N NaOH and transported back to the radioanalytical laboratory for I-131 analysis. A second sample of between 750 and 1000 grams is also collected from each location. After drying and grinding, this sample is analyzed by gamma spectroscopy. Once each quarter, the sample is ashed after the gamma analysis is completed and analyzed for Sr-89,90.

Soil samples are collected annually from the air monitoring locations. The samples are collected with either a "cookie cutter" or an auger type sampler. After drying and grinding, the sample is analyzed by gamma spectroscopy. When the gamma analysis is complete, the sample is ashed and analyzed for Sr-89,90.

Samples representative of food crops raised in the area near the plant are obtained from individual gardens, corner markets, or cooperatives. Types of foods may vary from year to year as a result of changes in the local vegetable gardens. In 1989 samples of cabbage, corn, green beans, potatoes, and tomatoes were collected from local vegetable gardens. In addition, samples of apples were also obtained from the area.

The edible portion of each sample is prepared as if it were to be eaten and is analyzed by gamma spectroscopy. After drying, grinding, and ashing, the sample is analyzed for gross beta activity.

Results

The results from the analysis of milk samples are presented in table H-4. No radioactivity which could be attributed to SQN was identified. All I-131 results were less than the established nominal LLD of 0.2 pCi/liter. Cesium-137 was identified in five samples at a level slightly higher than the LLD. Strontium-90 was found in less than half of the samples. These levels are consistent with concentrations measured in samples collected prior to plant operation and with concentrations reported in milk as a result of fallout from atmospheric nuclear weapons tests (reference 1). The average Sr-90 concentration reported from indicator stations was 9.5 pCi/liter. An average of 2.4 pCi/liter was identified in samples from control stations. By far the predominant isotope reported in milk samples was the naturally occurring K-40. An average of approximately 1300 pCi/liter of K-40 was identified in all milk samples.

As has been noted in this series of reports for previous years, the levels of Sr-90 in milk samples from farms producing milk for private consumption only are up to six times the levels found in milk from commercial dairy farms. Samples of feed and water supplied to the animals were analyzed in 1979 in an effort to determine the source of the strontium. Analysis of dried hay samples indicated levels of Sr-90 slightly higher than those encountered in routine vegetation samples. Analysis of pond water indicated no significant strontium activity.

This phenomenon was observed during the preoperational radiological monitoring near SQN and near the Bellefonte Nuclear Plant (under construction) at farms where only one or two cows were being milked for private consumption of the milk. It is postulated that the feeding practices of these small farms differ from those of the larger dairy farmers to the extent that fallout from atmospheric nuclear weapons testing may be more concentrated in these instances. Similarly, Hansen, et al. (reference 4), reported an inverse relationship between the levels of Sr-90 in milk and the quality of fertilization and land management.

Results from the analysis of vegetation samples (table H-5) were similar to those reported for milk. Eleven samples had an I-131 value slightly higher than the nominal LLD. The average concentration at indicator stations was 4.8 pCi/kg while the average at control stations was 4.9 pCi/kg. Cesium-137 was identified at two stations at an average concentration of 36.2 pCi/kg. No cesium was found in samples from the control stations. Strontium-90 levels averaged 111 pCi/kg from indicator stations and 62 pCi/kg from control stations. Again, the largest concentrations identified were for the naturally occurring isotopes K-40 and Be-7.

The only fission or activation products identified in soil samples were Cs-137 (identified in all 13 samples) and Sr-90 (identified in one sample). The maximum concentration of Cs-137 was 1.08 pCi/g and the Sr-90 concentration was 0.3 pCi/g. These values are consistent with levels previously reported from fallout. All other radionuclides reported were naturally occurring isotopes (table H-6).

With the exception of 7.6 pCi/kg of Cs-137 identified in one sample of potatoes, all radionuclides reported in food samples were naturally occurring. The maximum K-40 value was 3500 pCi/kg in potatoes. Gross beta concentrations for all indicator samples were consistent with the control values. Analysis of these samples indicated no contribution from plant activities. The results are reported in tables H-7 through H-12.

AQUATIC MONITORING

Potential exposures from the liquid pathway can occur from drinking water, ingestion of edible fish and clams, or from direct radiation exposure from radioactive materials deposited in the river sediment. The aquatic monitoring program includes the collection of samples of river (reservoir) water, groundwater, drinking water supplies, fish, Asiatic clams, and bottom and shoreline sediment. Samples from the reservoir are collected both upstream and downstream from the plant.

Results from the analysis of aquatic samples are presented in tables H-13 through H-22. Radioactivity levels in water, fish, and clams were consistent with background and/or fallout levels previously reported. The presence of Co-60 and Cs-137 was identified in some samples; however, the projected exposure to the public is negligible.

Sample Collection and Analysis

Samples of surface water are collected from the Tennessee River using automatic sampling pumps from two downstream stations and one upstream station. A timer turns on the pump at least once every 2 hours. The line is flushed and a sample collected into a composite jug. A 1-gallon sample is removed from the composite jug at 4-week intervals and the remaining water in the jug is discarded. The composite sample is analyzed by gamma spectroscopy and for gross beta activity. A quarterly composite sample is analyzed for Sr-89,90 and tritium.

Samples are also collected by an automatic sampling pump at the first downstream drinking water intake. These samples are collected in the same manner as the surface water samples. These monthly samples are analyzed by gamma spectroscopy and for gross beta activity. At other selected locations, grab samples are collected from drinking water systems which use the Tennessee River as their source. These samples are analyzed every 4 weeks by gamma spectroscopy and for gross beta activity. A quarterly composite sample from each station is analyzed for Sr-89,90 and tritium. The sample collected by the automatic pumping device is taken directly from the river at the intake structure. Since the sample at this point is raw water, not water processed through the water treatment plant, the control sample should also be unprocessed water. Therefore, the upstream surface water sample is also considered as a control sample for drinking water.

Groundwater is sampled from an onsite well and from a private well in an area unaffected by SQN. The samples are composited by location quarterly and analyzed by gamma spectroscopy and for gross beta activity and tritium content.

Samples of commercial and game fish species are collected semiannually from each of three reservoirs: the reservoir on which the plant is located (Chickamauga Reservoir), the upstream reservoir (Watts Bar Reservoir), and the downstream reservoir (Nickajack Reservoir). The samples are collected using a combination of netting techniques and electrofishing. Most of the fish are filleted, but one group is processed whole for analysis. After drying and grinding, the samples are analyzed by gamma spectroscopy. When the gamma analysis is completed, the sample is ashed and analyzed for gross beta activity.

Bottom and shoreline sediment is collected semiannually from selected reservoir locations using a dredging apparatus. The samples are dried and ground and analyzed by gamma spectroscopy. After this analysis is complete, the samples are ashed and analyzed for Sr-89,90.

Samples of Asiatic clams are collected semiannually from three of the the same locations as the bottom sediment. The clams are usually collected in the dredging process with the sediment. However, at times the clams are difficult to find. Approximately 50 grams of wet flesh are required for analysis. During this period, sufficient quantities of clams were found at only one station. The flesh is separated from the shells, and the dried flesh samples are analyzed by gamma spectroscopy.

Results

Gross beta activity was present in most surface water samples. Concentrations in downstream samples averaged 2.6 pCi/L while the upstream samples averaged 2.7 pCi/L. Concentrations of all gamma emitting fission and activation products were all less than the respective LLDs. The positive identification of Sr-89 at levels near the LLD is typically a result of artifacts in the calculational process. A trend plot of the gross beta activity in surface water samples from 1971 through 1989 is presented in figure H-4. A summary table of the results is shown in table H-13.

No fission or activation products were identified in drinking water samples. As noted above, the positive identification of Sr-89 at levels near the LLD is typically a result of artifacts in the calculational process. Average gross beta activity was 2.4 pCi/liter at the downstream stations and 2.8 pCi/liter at the control stations. The results are shown in table H-14 and a trend plot of the gross beta activity in drinking water from 1971 to the present is presented in figure H-5.

The only fission or activation product identified in ground water was tritium, at a concentration of 379 pCi/liter. The average gross beta concentration in samples from the onsite well was 3.3 pCi/liter, while the average from the offsite well was 5.4 pCi/liter. The results are presented in table H-15.

Cesium-137 was identified in 5 fish samples. The downstream samples contained a maximum of 0.10 pCi/g, while the upstream sample had a maximum of 0.21 pCi/g. Other radioisotopes found in fish were naturally occurring with the most notable being K-40. The concentrations of K-40 ranged from 4.0 pCi/g to 17.2 pCi/g. These results, which are summarized in tables H-16, H-17, H-18, and H-19, indicate that the Cs-137 activity is probably a result of fallout or other upstream effluents rather than activities at SQN.

Radionuclides of the types produced by nuclear power plant operations were identified in sediment samples. The materials identified were Cs-137 and Co-60. In bottom sediment samples the average levels of Cs-137 were 0.91 pCi/g in downstream samples and 0.97 pCi/g upstream. In shoreline sediment, Cs-137 levels were 0.07 and 0.02 pCi/g, respectively, in downstream and upstream samples. These values are consistent with previously identified fallout levels; therefore, they are probably not a result of SQN operations.

In bottom sediment, Co-60 concentrations in downstream samples averaged 0.10 pCi/g, while concentrations upstream averaged 0.05 pCi/g. The maximum concentrations were 0.20 and 0.06 pCi/g, respectively. A realistic assessment of the impact to the general public from this activity produces a negligible dose equivalent. Results from the analysis of bottom sediment samples are shown in table H-20.

Co-60 was identified in two shoreline sediment samples. A maximum concentration of 0.03 pCi/g was found in a downstream station. This is less than the Co-60 levels found in upstream bottom sediment samples, indicating no impact from SQN. Results from the analysis of shoreline sediment samples are shown in table H-21.

As noted above, clam samples were available from only one station. All fission and activation products were below the lower limits of detection. The analysis of this sample is documented in table H-22.

ASSESSMENT AND EVALUATION

Potential doses to the public are estimated from measured effluents using computer models. These models were developed by TVA and are based on guidance provided by the NRC in Regulatory Guide 1.109 for determining the potential dose to individuals and populations living in the vicinity of the plant. The doses calculated are a representation of the dose to a "maximum exposed individual." Some of the factors used in these calculations (such as ingestion rates) are maximum expected values which will tend to overestimate the dose to this "maximum" person. In reality, the expected dose to actual individuals is lower.

The area around the plant is analyzed to determine the pathways through which the public may receive an exposure. As indicated in figure 2, the two major ways by which radioactivity is introduced into the environment are through liquid and gaseous effluents.

For liquid effluents, the public can be exposed to radiation from three sources: drinking water from the Tennessee River, eating fish caught in the Tennessee River, and direct exposure to radioactive material due to activities on the banks of the river (recreational activities). Data used to determine these doses are based on guidance given by the NRC for maximum ingestion rates, exposure times, and distribution of the material in the river. Whenever possible, data used in the dose calculation are based on specific conditions for the SQN area.

For gaseous effluents, the public can be exposed to radiation from several sources: direct radiation from the radioactivity in the air, direct radiation from radioactivity deposited on the ground, inhalation of radioactivity in the air, ingestion of vegetation which contains radioactivity deposited from the atmosphere, and ingestion of milk or meat from animals which consumed vegetation containing deposited radioactivity. The concentrations of radioactivity in the air and the soil are estimated by computer models which use the actual meteorological conditions to determine the distribution of the effluents in the atmosphere. Again, as many of the parameters as possible are based on actual site specific data.

Results

The estimated doses to the maximum exposed individual due to radioactivity released from SQN in 1989 are presented in table 2. These estimates were made using the measured concentrations of the liquid and gaseous effluents. Also shown are the regulatory limits for these doses and a comparison between the calculated dose and the corresponding limit. The maximum calculated whole body dose equivalent from measured liquid effluents as presented in table 2 is 0.009 mrem/year, or 0.3 percent of the limit. The maximum organ dose equivalent from gaseous effluents is 0.05 mrem/year. This represents less than 1 percent of the Technical Specification limit. A more complete description of the effluents released from SQN and the corresponding doses projected from these effluents can be found in the SQN annual radiological impact reports.

As stated earlier in the report, the estimated increase in radiation dose equivalent to the general public resulting from the operation of SQN is trivial when compared to the dose from natural background radiation. The results from each environmental sample are compared with the concentrations from the corresponding control stations and appropriate preoperational and background data to determine influences from the plant. During this report period, Co-60 and Cs-137 were seen in aquatic media. Cs-137 in sediment is consistent with fallout levels identified in samples both upstream and downstream from the plant. Co-60 was identified in sediment samples downstream from the plant in concentrations which would produce no measurable increase in the dose to the general public. No increases of radioactivity attributable to SQN have been seen in water samples.

Dose estimates were made from concentrations of radioactivity found in samples of environmental media. Media evaluated include, but are not limited to, air, milk, food products, drinking water, and fish. Inhalation and ingestion doses estimated for persons at the indicator locations were essentially identical to those determined for persons at control stations. Greater than 95 percent of those doses were contributed by the naturally occurring radionuclide K-40 and by Sr-90 and Cs-137, which are long-lived radioisotopes found in fallout from nuclear weapons testing. Concentrations of Sr-90 and Cs-137 are consistent with levels measured in TVA's preoperational environmental radiological monitoring programs.

Conclusions

It is concluded from the above analysis of the environmental sampling results and from the trend plots presented in appendix H that the exposure to members of the general public which may have been attributable to SQN is negligible. The radioactivity reported herein is primarily the result of fallout or natural background radiation. Any activity which may be present as a result of plant operations does not represent a significant contribution to the exposure of members of the public.

REFERENCES

1. Merril Eisenbud, Environmental Radioactivity, Academic Press, Inc., New York, NY, 1987.

2. National Council on Radiation Protection and Measurements, Report No. 93, "Ionizing Radiation Exposure of the Population of the United States," September 1987.

3. United States Nuclear Regulatory Commission, Regulatory Guide 8.29, "Instruction Concerning Risks From Occupational Radiation Exposure," July 1981.

4. Hansen, W. G., Campbell, J. E., Fooks, J. H., Mitchell, H. C., and Eller, C. H., Farming Practices and Concentrations of Emission Products in Milk, U.S. Department of Health, Education, and Welfare; Public Health Service Publication No. 999-R-6, May 1964.

Table 1

MAXIMUM PERMISSIBLE CONCENTRATIONS

FOR NONOCCUPATIONAL EXPOSURE

	MPC	
	In Water pCi/l*	In Air pCi/m³*
Gross beta	3,000	100
H-3	3,000,000	200,000
Cs-137	20,000	500
Ru-103,106	10,000	200
Ce-144	10,000	200
Zr-95 - Nb-95	60,000	1,000
Ba-140 - La-140	20,000	1,000
I-131	300	100
Zn-65	100,000	2,000
Mn-54	100,000	1,000
Co-60	30,000	300
Sr-89	3,000	300
Sr-90	300	30
Cr-51	2,000,000	80,000
Cs-134	9,000	400
Co-58	90,000	2,000

*1 pCi = 3.7×10^{-2} Bq.

Source: 10 CFR, Part 20, Appendix B, Table II.

Table 2

Maximum Dose due to Radioactive Effluent Releases
Sequoyah Nuclear Plant
1989
mrem/year

Liquid Effluents

Type	1989 Dose	NRC Limit	Percent of NRC Limit	EPA Limit	Percent of EPA Limit
Total Body	0.009	3	0.3	25	0.04
Any Organ	0.011	10	0.1	25	0.04

Gaseous Effluents

Type	1989 Dose	NRC Limit	Percent of NRC Limit	EPA Limit	Percent of EPA Limit
Noble Gas (Gamma)	0.33	10	3.3	25	1.3
Noble Gas (Beta)	0.89	20	4.5	25	3.6
Any Organ	0.05	15	0.3	25	0.2

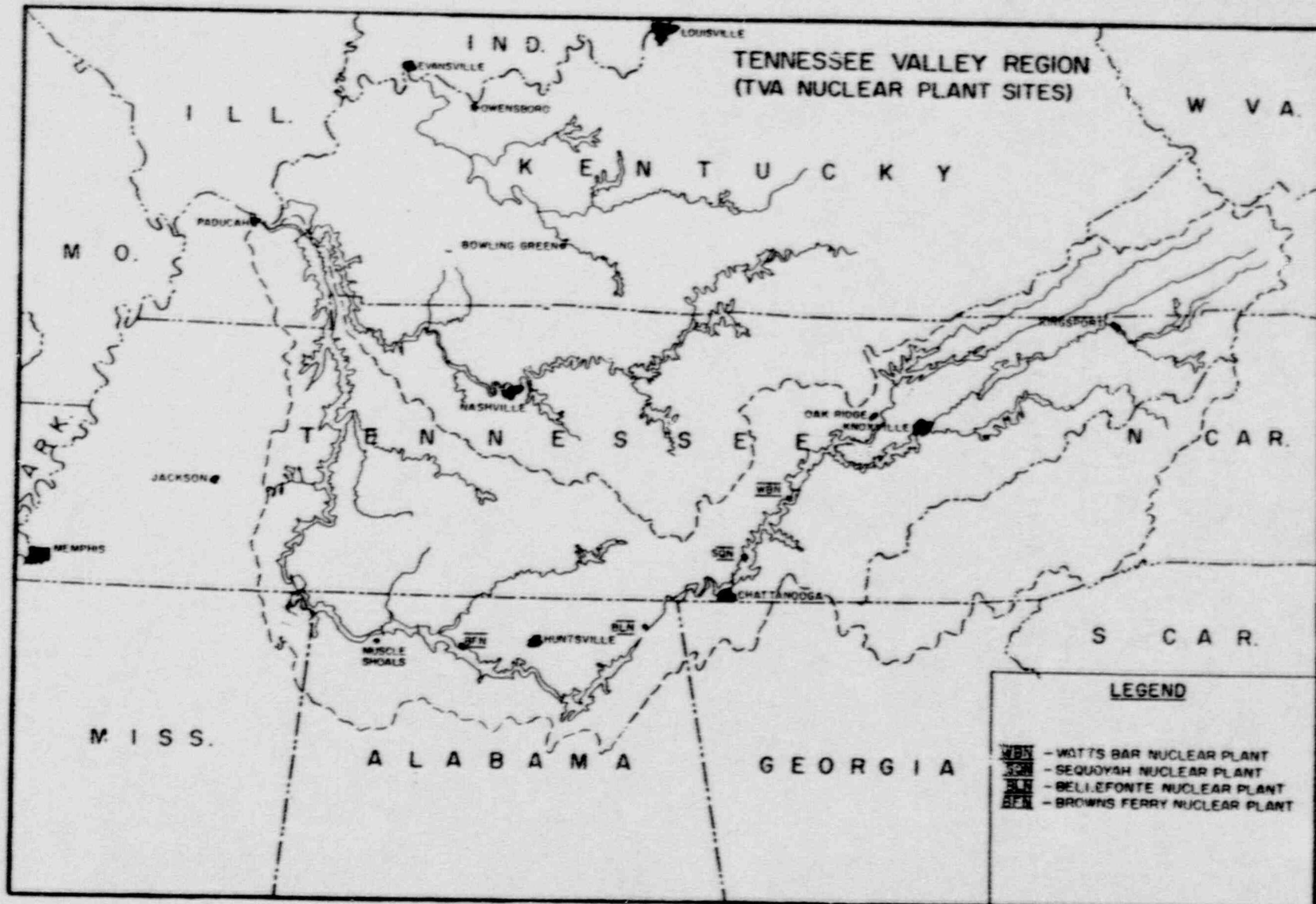
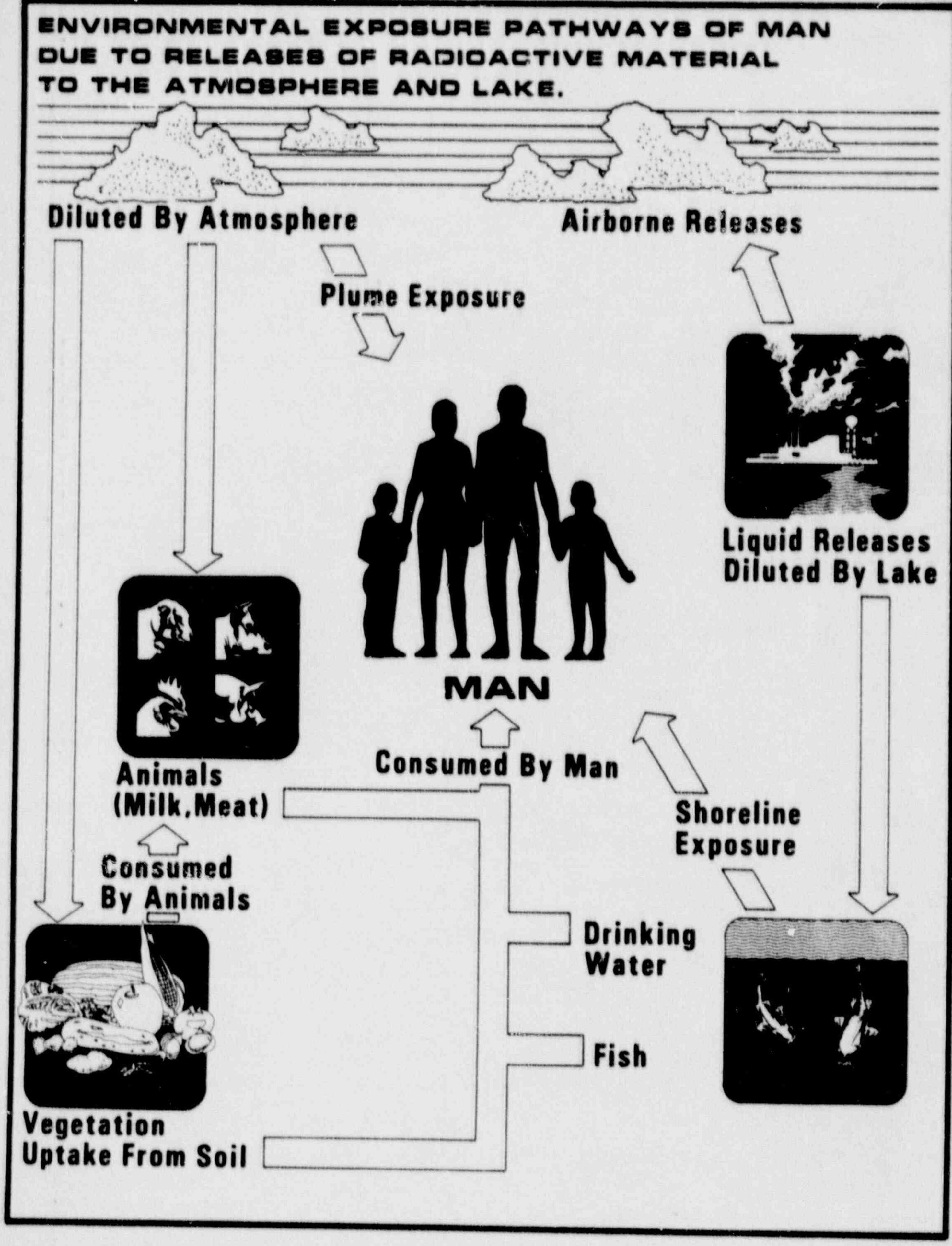

TENNESSEE VALLEY REGION
(TVA NUCLEAR PLANT SITES)
IND.
ILL.
MO.
ARK.
KENTUCKY
W VA.
TENNESSEE
N CAR.
S CAR.
MISS.
ALABAMA
GEORGIA
LOUISVILLE
EVANSVILLE
OWENSBORO
PADUCAH
BOWLING GREEN
NASHVILLE
JACKSON
MEMPHIS
OAK RIDGE
KNOXVILLE
KINGSPORT
WBN
SQN
CHATTANOOGA
BLN
HUNTSVILLE
BFN
MUSCLE SHOALS
LEGEND
WBN - WATTS BAR NUCLEAR PLANT
SQN - SEQUOYAH NUCLEAR PLANT
BLN - BELLEFONTE NUCLEAR PLANT
BFN - BROWNS FERRY NUCLEAR PLANT

Figure 1

Figure 2



ENVIRONMENTAL EXPOSURE PATHWAYS OF MAN DUE TO RELEASES OF RADIOACTIVE MATERIAL TO THE ATMOSPHERE AND LAKE.
Diluted By Atmosphere
Airborne Releases
Plume Exposure
Liquid Releases Diluted By Lake
MAN
Consumed By Man
Animals (Milk, Meat)
Shoreline Exposure
Consumed By Animals
Drinking Water
Fish
Vegetation Uptake From Soil

APPENDIX A

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM AND SAMPLING LOCATIONS

Table A-1

SEQUOYAH NUCLEAR PLANT

Environmental Radiological Monitoring Program[a]

Exposure Pathway and/or Sample	Sample Locations[b]	Sampling and Collection Frequency	Type and Frequency of Analysis
1. AIRBORNE			
a. Particulates	4 samples from locations (in different sectors) at or near the site boundary (LM 2, 3, 4, and 5)	Continuous sampler operation with sample collection once per 7 days (more frequently if required by dust loading)	Analyze for gross beta radioactivity greater than or equal to 24 hours following filter change. Perform gamma isotopic analysis on each sample if gross beta is greater than 10 times yearly mean of control sample. Composite at least once per 31 days (by location for gamma scan).
	4 samples from communities approximately 6-10 miles distance from the plant (PM 2, 3, 8, and 9)		
	4 samples from control locations greater than 10 miles from the plant (RM 1, 2, 3, and 4)		
b. Radioiodine	Samples from same location as air particulates	Continuous sampler operation with filter collection once per 7 days	I-131 at least once per 7 days
c. Soil	Samples from same locations as air particulates	Once per year	Gamma scan, Sr-89, Sr-90, once each year
d. Rainwater	Same locations as air particulate	Composite sample at least once per 31 days	Analyzed for gamma nuclides only if radioactivity in other media indicates the presence of increased levels of fallout
2. DIRECT RADIATION	2 or more dosimeters (TLDs) placed at 11 of the air particulate sampling stations (LM-3, LM-4, LM-5, PM-2, PM-3, PM-8, PM-9, RM-1, RM-2, RM-3, and RM-4	Once per 92 days	Gamma dose at least once per 92 days
	2 or more dosimeters (TLDs) placed at each of at least 30 other locations		

Table A-1

SEQUOYAH NUCLEAR PLANT
Environmental Radiological Monitoring Program[a]

Exposure Pathway and/or Sample	Sample Locations[b]	Sampling and Collection Frequency	Type and Frequency of Analysis
3. WATERBORNE			
a. Surface	TRM 497.0 TRM 483.4 TRM 473.2	Collected by automatic sequential-type sampler[c] with composite samples collected over a period of less than or equal to 32 days	Gamma scan of each composite sample. Composite for Sr-89, Sr-90, and tritium analysis at least once per 92 days.
b. Ground	1 sample adjacent to plant (Well No.6)	At least once per 31 days	Composited for gross beta, gamma scan, and tritium analysis at least once per 92 days
	1 sample from ground water source upgradient (Farm HW)	At least once per 92 days	Gross beta, gamma scan, and tritium analysis at least once per 92 days
c. Drinking	1 sample at the first potable surface water supply downstream from the plant (TRM 473.0)	Collected by automatic sequential-type sampler[c] with composite sample collected over a period of less than or equal to 31 days	Gross beta and gamma scan of each composite sample. Composite for tritium, Sr-89, Sr-90, at least once per 92 days.
	1 sample at the next 2 downstream potable surface water suppliers (greater than 10 miles downstream) (TRM 470.5 and 465.3)	Grap sample once per 31 days	
	2 samples at control locations (TRM 497.0 and TRM 503.8)	Samples collected by sequential-type sampler[c] with composite sample collected over a period of less than or equal to 31 days	
d. Sediment	TRM 496.5 TRM 483.4 TRM 480.8 TRM 472.8	At least once per 184 days	Gamma scan of each sample
e. Shoreline Sediment	TRM 485 TRM 478 TRM 477	At least once per 184 days	Gamma scan of each sample

Table A-1

SEQUOYAH NUCLEAR PLANT
Environmental Radiological Monitoring Program*

Exposure Pathway and/or Sample	Sample Locations[b]	Sampling and Collection Frequency	Type and Frequency of Analysis
4. INGESTION			
a. Milk	1 sample from milk producing animals in each of 1-3 areas indicated by the cow census where doses are calculated to be highest (Farms J, H, and HW). If samples are not available from a milk animal location, doses to that area will be estimated by projecting the doses from concentrations detected in milk from other sectors or by sampling vegetation where milk is not available (Farm EM). At least 1 sample from a control location (Farms B, C, and/or S)	At lest once per 15 days	Gamma isotopic and I-131 analysis of each sample. Sr-89, Sr-90, once per quarter
b. Fish	1 sample each for Nickajack, Chickamauga, and Watts Bar Reservoirs	At lest once per 184 days. One sample of each of the following species: Channel Catfish Crappie Smallmouth Buffalo	Gamma scan on edible portion
c. Invertebrates (Asiatic Clams)	TRM 496.5 TRM 483.4 TRM 460.8	At least once per 184 days	Gamma scan on edible portion
d. Food Products	1 sample each of principal food products grown at private gardens and/or farms in the immediate vicinity of the plant.	At least once per 365 days at time of harvest. The types of foods available for sampling will vary. Following is a list of typical foods which may be available: Cabbage and/or lettuce Corn Green Beans Potatoes Tomatoes	Gamma scan on edible portion

Table A-1

SEQUOYAH NUCLEAR PLANT
Environmental Radiological Monitoring Program[a]

Exposure Pathway and/or Sample	Sample Locations[b]	Sampling and Collection Frequency	Type and Frequency of Analysis
e. Vegetation	1 sample from one location of milk-producing animals where a sample of milk is not available (Farm EM) and from one control dairy farm (Farm S)	At least once per 31 days	I-131 and Gamma scan at least once per 31 days. Sr-89, Sr-90 analysis at least once per 92 days.

Table A-2

SEQUOYAH NUCLEAR PLANT

Environmental Radiological Monitoring Program
Sampling Locations

Map Location Number[a]	Station	Sector	Approximate Distance (miles)	Indicator (I) or Control (C)	Samples Collected[b]
2	LM-2	N	0.8	I	AP,CF,R,S,V[c]
3	LM-3	SSW	1.2	I	AP,CF,R,S,V[c]
4	LM-4	NE	1.5	I	AP,CF,R,S,V[c]
5	LM-5	NNE	1.8	I	AP,CF,R,S,V[c]
7	PM-2	SW	3.8	I	AP,CF,R,S,
8	PM-3	W	5.6	I	AP,CF,R,S,
9	PM-8	SSW	8.7	I	AP,CF,R,S,
10	PM-9	WSW	2.6	I	AP,CF,R,S,
11	RM-1	SW	16.7	C	AP,CF,R,S,
12	RM-2	NNE	17.8	C	AP,CF,R,S,
13	RM-3	ESE	11.3	C	AP,CF,R,S,
14	RM-4	WNW	18.9	C	AP,CF,R,S,V[c]
15	Farm B	NE	43.0	C	M
16	Farm C	NE	16.0	C	M
17	Farm S	NNE	12.0	C	M,V
18	Farm J	WNW	1.1	I	M,V[c]
19	Farm HW	NW	1.2	I	M,V[c],W[d]
20	Farm EM	N	2.6	I	V
21	Farm Br[e]	SSW	2.2	I	V[c]
24	Well No. 6	NNE	0.15	I	W
31	TRM 473.0 (C.F. Industries)	--	11.5[f]	I	PW
32	TRM 470.5 (E.I. DuPont)	--	14.0[f]	I	PW
33	TRM 465.3 (Chattanooga)	--	19.2[f]	I	PW
34	TRM 497.0	--	12.5[f]	C[g]	SW
35	TRM 503.8 (Dayton)	--	19.3[f]	C	PW
36	TRM 496.5	--	12.0[f]	C	CL,SD
37	TRM 485.0	--	0.5[f]	C	SS
38	TRM 483.4	--	1.1[f]	I	CL,SD,SW
39	TRM 480.8	--	3.7[f]	I	CL,SD
40	TRM 477.0	--	7.5[f]	I	SS
41	TRM 473.2	--	11.3[f]	I	SW
42	TRM 472.8	--	11.7[f]	I	SD
44	TRM 478.8	--	6.5[f]	I	SS

Table A-2

SEQUOYAH NUCLEAR PLANT

Environmental Radiological Monitoring Program
Sampling Locations
(Continued)

Map Location Number[a]	Station	Sector	Approximate Distance (miles)	Indicator (I) or Control (C)	Samples Collected[b]
45	TRM 425-471 (Nickajack Reservoir)	--	--	I	F
46	TRM 471-530 (Chickamauga Reservoir)	--	--	I	F
47	TRM 530-602 (Watts Bar Reservoir)	--	--	C	F
48	Farm H	NE	4.2	I	M,V[c]

a. See figures A-1, A-2, and A-3
b. Sample Codes

AP = Air particulate filter
CF = Charcoal filter
CL = Clams
F = Fish
M = Milk
PW = Public water
R = Rainwater
S = Soil
SD = Sediment
SS = Shoreline sediment
SW = Surface water
V = Vegetation
W = Well water

c. Vegetation sampling discontinued in July 1989.
d. A control for well water.
e. Milk producing animal not identified in 1988 land use survey - vegetation sampling continued until July 1989.
f. Distance from plant discharge (TRM 484.5)
g. Surface water sample also used as a control for public water.

Table A-3

SEQUOYAH NUCLEAR PLANT

Thermoluminescent Dosimeter (TLD) Locations

Map Location Number	Station	Sector	Approximate Distance (Miles)	Onsite (On)[a] or Offsite (Off)
3	SSW-1A	SSW	1.2	On
4	NE-1A	NE	1.5	On
5	NNE-1	NNE	1.8	On
7	SW-2	SW	3.8	Off
8	W-3	W	5.6	Off
9	SSW-3	SSW	8.7	Off
10	WSW-2A	WSW	2.6	Off
11	SW-3	SW	16.7	Off
12	NNE-4	NNE	17.8	Off
13	ESE-3	ESE	11.3	Off
14	WNW-3	WNW	18.9	Off
49	N-1	N	0.6	On
50	N-2	N	2.1	Off
51	N-3	N	5.2	Off
52	N-4	N	10.0	Off
53	NNE-2	NNE	4.5	Off
54	NNE-3	NNE	12.1	Off
55	NE-1	NE	2.4	Off
56	NE-2	NE	4.1	Off
57	ENE-1	ENE	0.4	On
58	ENE-2	ENE	5.1	Off
59	E-1	E	1.2	On
60	E-2	E	5.2	Off
61	ESE-A	ESE	0.4	On
62	ESE-1	ESE	1.2	On
63	ESE-2	ESE	4.9	Off
64	SE-A	SE	0.4	On
65	SE-B	SE	0.4	On
66	SE-1	SE	1.4	On
67	SE-2	SE	1.9	On
68	SE-4	SE	5.2	Off
69	SSE-1	SSE	1.6	On
70	SSE-2	SSE	4.6	Off
71	S-1	S	1.5	On
72	S-2	S	4.7	Off
73	SSW-1	SSW	0.6	On
74	SSW-2	SSW	4.0	Off
75	SW-1	SW	0.9	On
76	WSW-1	WSW	0.9	On
77	WSW-2	WSW	2.5	Off

Table A-3

SEQUOYAH NUCLEAR PLANT

Thermoluminescent Dosimeter (TLD) Locations

Map Location Number	Station	Sector	Approximate Distance (Miles)	Onsite (On)[a] or Offsite (Off)
78	WSW-3	WSW	5.7	Off
79	WSW-4	WSW	7.8	Off
80	WSW-5	WSW	10.1	Off
81	W-1	W	0.8	On
82	W-2	W	4.3	Off
83	WNW-1	WNW	0.4	On
84	WNW-2	WNW	5.3	Off
85	NW-1	NW	0.4	On
86	NW-2	NW	5.2	Off
87	NNW-1	NNW	0.6	On
88	NNW-2	NNW	1.7	On
89	NNW-3	NNW	5.3	Off

a. TLDs designated onsite are those located 2 miles or less from the plant. TLDs designated offsite are those located more than 2 miles from the plant.

Figure A-1

Environmental Radiological Sampling Locations
Within 1 Mile of Plant

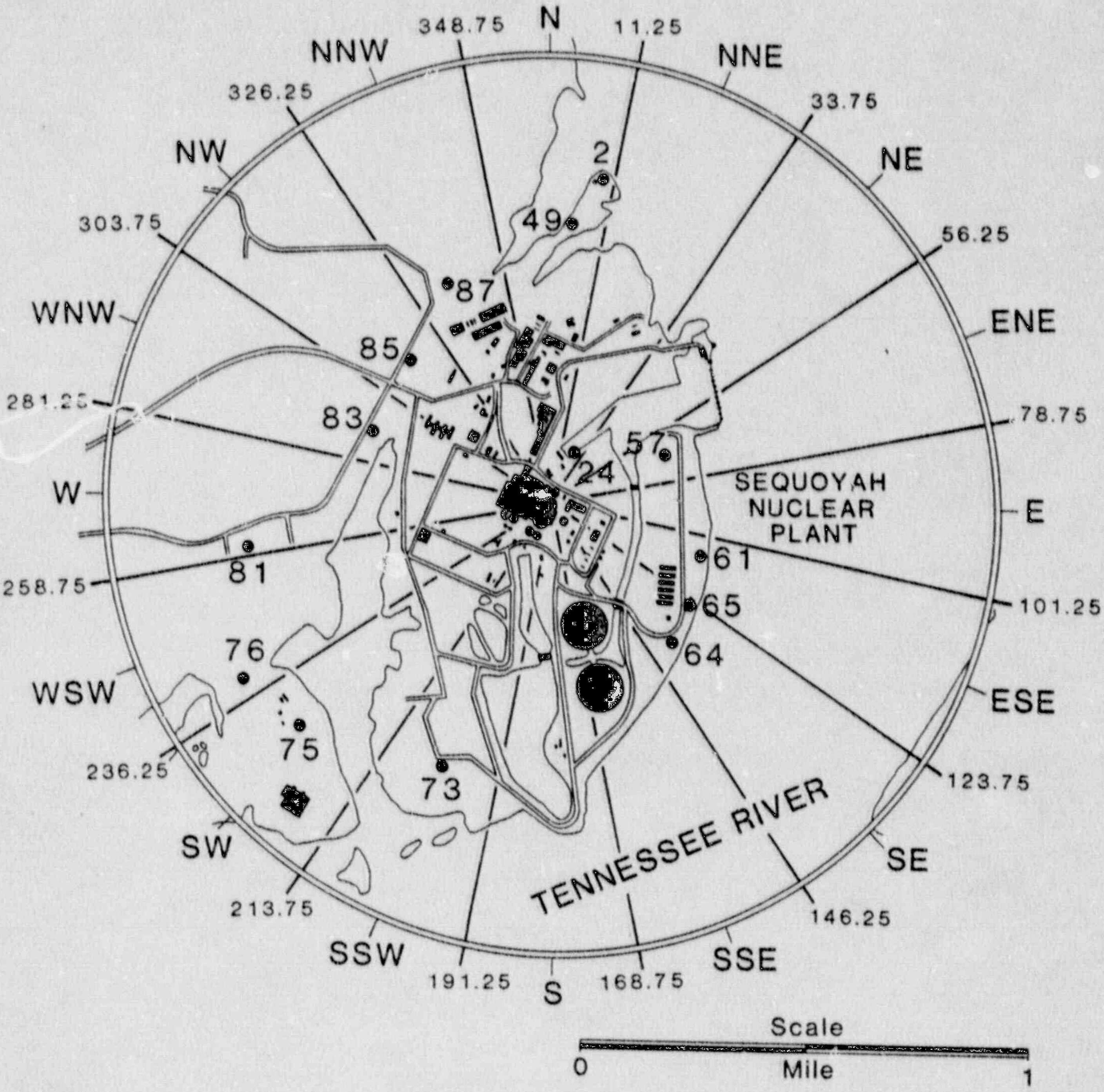


Figure A-2

Environmental Radiological Sampling Locations
From 1 to 5 Miles From The Plant

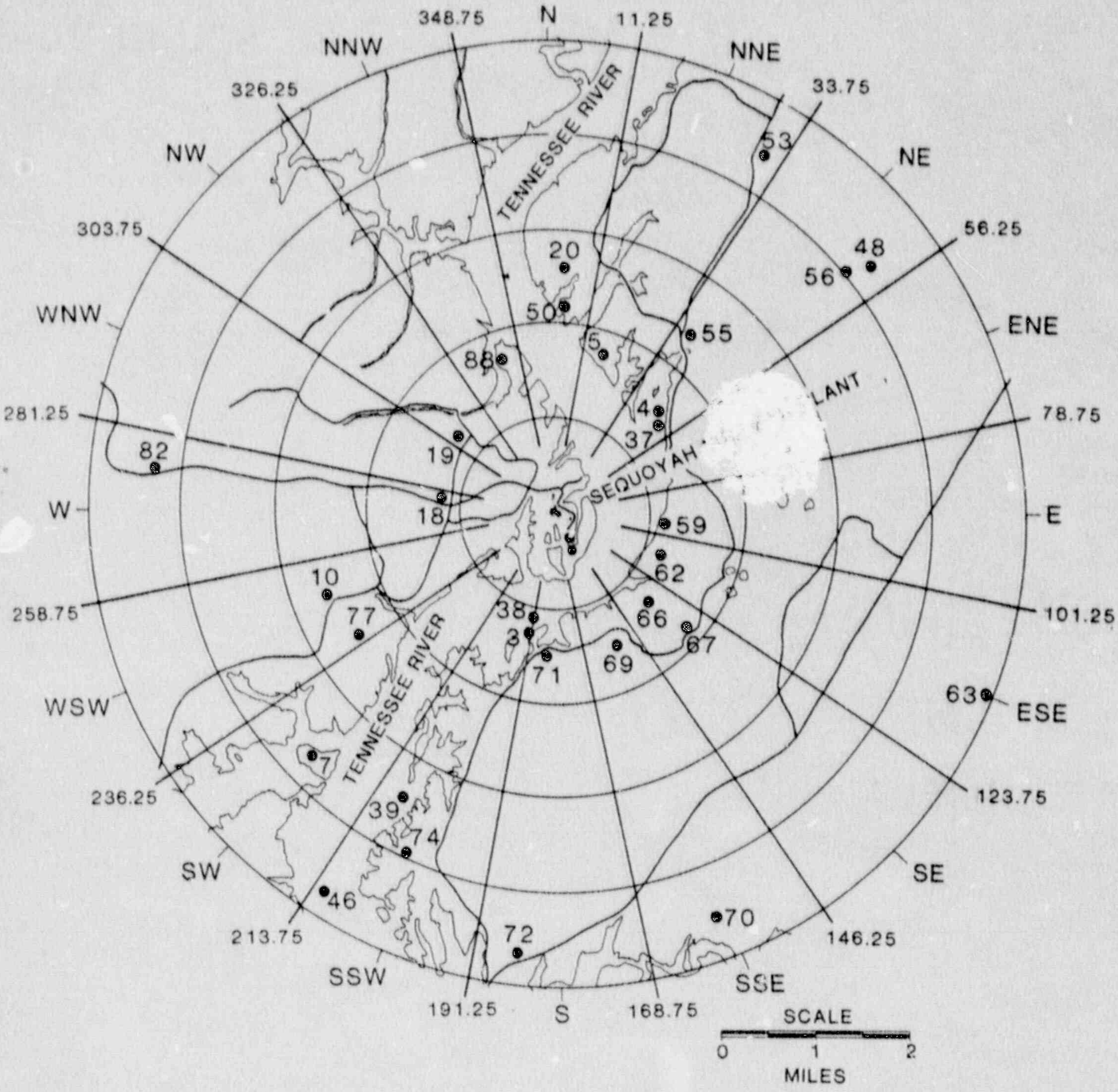
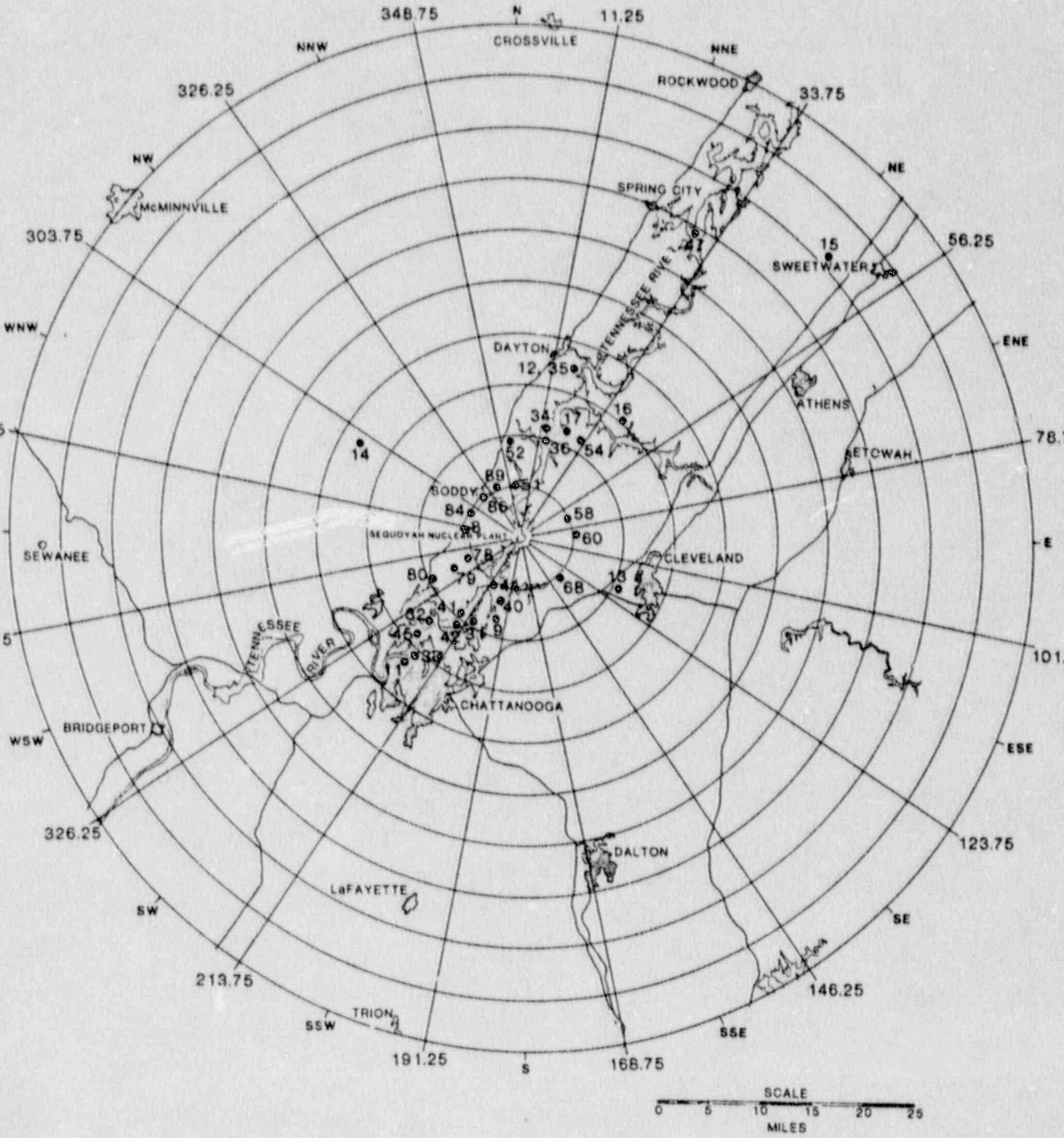


Figure A-3

Environmental Radiological Sampling Locations Greater Than 5 Miles From The Plant



APPENDIX B

1989 PROGRAM MODIFICATIONS

Appendix B

Environmental Radiological Monitoring Program Modification

During 1989 the only modification to the environmental monitoring program was the reduction in the number of locations from which vegetation samples were taken.

In addition to the air and milk samples collected from the vicinity of the plant, vegetation (grass) samples have been collected for several years. The results produced during this time indicate that the air and milk samples provide an earlier indication of changes in environmental concentrations than do the vegetation samples. Therefore, vegetation sampling has been discontinued at all but two stations. Collection of the other scheduled samples from these stations continues.

See tables A-2 and B-1 for locations no longer sampled.

Table B-1

SEQUOYAH NUCLEAR PLANT

Environmental Radiological Monitoring Program Modifications
1989

Date	Station	Modification
7/89	LM-2, LM-3, LM-4, LM-5, RM-4, Farm J, Farm HW, Farm C, and Farm Br	Vegetation sampling discontinued

APPENDIX C

MISSED SAMPLES AND ANALYSES

Appendix C

Missed Samples and Analyses

During the 1989 sampling period, a small number of samples were not collected and several analyses were not completed on some collected samples. These occurrences resulted in deviations from the scheduled program but not from the program required by the Technical Specifications. A list of missed samples and analyses are found in table C-1.

The missed samples resulted from equipment malfunction, construction and repairs in the area of samplers, scarcity of sample media, and sample unavailability. Some samples were "lost" or destroyed during analysis as a result of insufficient chemical recovery during the separation process. Equipment malfunctions were corrected, repairs completed, and potential causes for lost or destroyed samples were investigated.

Table C-1

SEQUOYAH NUCLEAR PLANT

Environmental Radiological Monitoring Program
Exceptions

Date	Station	Location	Remarks
1/9/89	Farm J	1.1 miles WNW	Milk samples not collected - insufficient sample available."
3/28/89	RM-4	18.9 miles WNW	Air particulate and charcoal filters not collected - equipment failure
4/26/89	TRM 496.5	12.0 miles upstream	Clam samples not collected - scarcity of clams prevented collection of adequate sample
	TRM 480.8	3.7 miles downstream	
5/30/89	RM-4	18.9 miles WNW	Sample fraction lost during iodine analysis.
6/20/89 6/27/89	LM-2	0.8 miles N	Air particulate and charcoal filter not collected - flooding prevented access to the station.
7/18/89 7/25/89	LM-2	0.8 miles N	Air particulate and charcoal filter not collected - belt broken
7/26/89 8/1/89	RM-3	11.3 miles ESE	Air particulate and charcoal filter not collected - power off for construction in area
10/3/89 10/10/89	LM-2	0.8 miles N	Air particulate and charcoal filter not collected - flooding prevented access to the station.
11/28/89 12/12/89	Farm J	1.1 miles WNW	Milk samples not available - cow "dry."

Table C-1

SEQUOYAH NUCLEAR PLANT

Environmental Radiological Monitoring Program
Exceptions
(Continued)

Date	Station	Location	Remarks
12/1/89	TRM 496.5	12.0 miles upstream	Clam samples collected late - scarcity of clams prevented collection of adequate sample
	TRM 483.4	1.1 miles downstream	
	TRM 480.8	3.7 miles downstream	
12/27/89	TRM 465.3	19.2 miles downstream	Sample not available - collection pipe frozen.

APPENDIX D

ANALYTICAL PROCEDURES

APPENDIX D

Analytical Procedures

All analyses are performed by the radioanalytical laboratory located at the Western Area Radiological Laboratory facility in Muscle Shoals. All analysis procedures are based on accepted methods. A summary of the analysis techniques and methodology follows.

The gross beta measurements are made with an automatic low background counting system. Normal counting times are 50 minutes. Water samples are prepared by evaporating 500 ml of samples to near dryness, transfering to a stainless steel planchet and completing the evaporation process. For solid samples, a specified amount of the sample is packed into a deep stainless steel planchet. Air particulate filters are counted directly in a shallow planchet.

The specific analysis of I-131 in milk, water, or vegetation samples is performed by first isolating and purifying the iodine by radiochemical separation and then counting the final precipitate on a beta-gamma coincidence counting system. The normal count time is 100 minutes. With the beta-gamma coincidence counting system, background counts are virtually eliminated and extremely low levels of detection can be obtained.

After a radiochemical separation, samples analyzed for Sr-89,90 are counted on a low background beta counting system. The sample is counted a second time after a 7-day ingrowth period. From the two counts the Sr-89 and Sr-90 concentrations can be determined.

Water samples are analyzed for tritium content by first distilling a portion of the sample and then counting by liquid scintillation. A commerically available scintillation cocktail is used.

Gamma analyses are performed in various counting geometries depending on the sample type and volume. All gamma counts are obtained with germanium type detectors interfaced with a computer-based mutlichannel analyzer system. Spectral data reduction is performed by the computer program HYPERMET.

The gaseous radioiodine analyses are performed with well-type NaI detectors interfaced with a single channel analyzer. The system is calibrated to measure I-131. If activity above a specified limit is detected, the sample is analyzed by gamma spectroscopy.

All of the necessary efficiency values, weight-efficiency curves, and geometry tables are established and maintained on each detector and counting system. A series of daily and periodic quality control checks are performed to monitor counting instrumentation. System logbooks and control charts are used to document the results of the quality control checks.

APPENDIX E

NOMINAL LOWER LIMITS OF DETECTION (LLD)

Appendix E

Nominal Lower Limits of Detection

Sensitive radiation detection devices can give a signal or reading even when no radioactivity is present in a sample being analyzed. This signal may come from trace amounts of radioactivity in the components of the device, from cosmic rays, from naturally occurring radon, or from machine noise. Thus, there is always some sort of signal on these sensitive devices. The signal registered when no activity is present in the sample is called the background.

The point at which the signal is determined to represent radioactivity in the sample is called the critical level. This point is based on statistical analysis of the background readings from any particular device. However, any sample measured over and over in the same device will give different readings; some higher than others. The sample should have some well-defined average reading, but any individual reading will vary from that average. In order to determine the activity present in a sample that will produce a reading above the critical level, additional statistical analysis of the background readings is required. The hypothetical activity calculated from this analysis is called the lower limit of detection (LLD). A listing of typical LLD values that a laboratory publishes is a guide to the sensitivity of the analytical measurements performed by the laboratory.

Every time an activity is calculated from a sample, the machine background must be subtracted from the sample signal. For the very low levels encountered in environmental monitoring, the sample signals are often very close to the background. The measuring equipment is being used at the limit of its capability. For a sample with no measureable activity, which often happens, about half the time its signal should fall below the average machine background and half the time it should be above the background. If a signal above the background is present, the calculated activity is compared to the calculated LLD to determine if there is really activity present or if the number is an artifact of the way radioactivity is measured.

A number of factors influence the LLD, including sample size, count time, counting efficiency, chemical processes, radioactive decay factors, and interfering isotopes encountered in the sample. The most likely values for these factors have been evaluated for the various analyses performed in the environmental monitoring program. The nominal LLDs calculated from these values, in accordance with the methodology prescribed in the Technical Specifications, are presented in the following table.

The LLDs are also presented in the data tables. For analyses for which LLDs have not been established, an LLD of zero is assumed in determining if a result is greater that the LLD.

Table E-1

Nominal LLD Values
A. Radiochemical Procedures

	Air Filters (pCi/m^3)	Charcoal Filters (pCi/m^3)	Water (pCi/L)	Milk (pCi/L)	Fish Flesh (pCi/g dry)	Whole Fish (pCi/g dry)	Food Crops (pCi/kg wet)	Sediment and Soil (pCi/g dry)
Gross Beta	0.002		1.7				9	
Tritium			250					
Iodine-131		.020	1.0	0.2				
Strontium-89	0.0006		3.0	2.5	0.3	0.7		1.0
Strontium-90	0.0003		1.4	2.0	0.04	0.09		0.3

	Wet Vegetation (pCi/kg Wet)	Clam Flesh (pCi/g Dry)	Meat (pCi/kg Wet)
Gross Beta		0.2	15
Iodine-131	4		
Strontium-89	140		
Strontium-90	60		

Table E-1

Nominal LLD Values
B. Gamma Analyses (GeLi)

	Air Particulates pCi/m3	Water and Milk pCi/L	Vegetation and Grain pCi/g. dry	Wet Vegetation pCi/kg. wet	Soil and Sediment pCi/g. dry	Fish pCi/g. dry	Clam Flesh pCi/g. dry	Foods, Tomatoes Potatoes, etc. pCi/kg. wet	Meat and Poultry pCi/kg. wet
Ce-141	.005	10	.07	28	.02	.07	.15	10	25
Ce-144	.01	33	.25	100	.06	.25	.50	33	50
Cr-51	.02	45	.45	180	.10	.45	.94	45	90
I-131	.005	10	.09	36	.02	.09	.18	10	20
Ru-103	.005	5	.05	20	.01	.05	.11	5	15
Ru-106	.02	40	.48	190	.09	.48	.95	40	95
Cs-134	.005	5	.07	28	.01	.07	.11	5	15
Cs-137	.005	5	.06	24	.01	.06	.10	5	15
Zr-95	.005	10	.11	44	.02	.11	.19	10	25
Nb-95	.005	5	.06	24	.01	.06	.11	5	15
Co-58	.005	5	.05	20	.01	.05	.10	5	15
Mn-54	.005	5	.05	20	.01	.05	.10	5	15
Zn-65	.005	10	.11	44	.01	.11	.21	10	25
Co-60	.005	5	.07	28	.01	.07	.11	5	15
K-40	.04	150	1.00	400	.20	1.00	2.00	150	300
Ba-140	.01	25	.23	92	.05	.23	.47	25	50
La-140	.005	8	.11	44	.02	.11	.17	8	20
Fe-59	.005	5	.10	40	.01	.10	.13	5	15
Be-7	.02	45	.50	200	.10	.50	.90	45	100
Pb-212	.005	20	.10	40	.02	.10	.25	20	40
Pb-214	.005	20	.20	80	.02	.20	.25	20	40
Bi-214	.005	20	.12	48	.04	.12	.25	20	40
Bi-212		53	.40	40	.25	.40		53	
Tl-208	.001	7	.03	26	.02	.03	.35	7	
Ra-224					.30				
Ra-226					.05				
Ac-228	.014	25	.10	80	.10	.10	1.00	22	22
Pa-234m		700			3.00				

APPENDIX F

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

Appendix F

Quality Assurance/Quality Control Program

A thorough quality assurance program is employed by the laboratory to ensure that the environmental monitoring data are reliable. This program includes the use of written, approved procedures in performing the work, a nonconformance and corrective action tracking system, systematic internal audits, a complete training and retraining system, audits by various external organizations, and a laboratory quality control program.

The quality control program employed by the radioanalytical laboratory is designed to ensure that the sampling and analysis process is working as intended. The program includes equipment checks and the analysis of special samples along with routine samples.

Radiation detection devices are complex and can be tested in a number of ways. There are two primary tests which are performed on all devices. In the first type, the device is operated without a sample on the detector to determine the background count rate. The background counts are usually low values and are due to machine noise, cosmic rays, or trace amounts of radioactivity in the materials used to construct the detector. Charts of background counts are kept and monitored to ensure that no unusually high or low values are encountered.

In the second test, the device is operated with a known amount of radioactivity present. The number of counts registered from such a radioactive standard should be very reproducible. These reproducibility checks are also monitored to ensure that they are neither higher nor lower than expected. When counts from either test fall outside the expected range, the device is inspected for malfunction or contamination. It is not placed into service until it is operating properly.

In addition to these two general checks, other quality control checks are performed on the variety of detectors used in the laboratory. The exact nature of these checks depends on the type of device and the method it uses to detect radiation or store the information obtained.

Quality control samples of a variety of types are used by the laboratory to answer questions about the performance of the different portions of the analytical process. These quality control samples may be blanks, replicate samples, blind samples, or cross-checks.

Blanks are samples which contain no measureable radioactivity or no activity of the type being measured. Such samples are analyzed to determine whether there is any contamination of equipment or commercial laboratory chemicals, cross-contamination in the chemical process, or interference from isotopes other than the one being measured.

Duplicate samples are generated at random by the same computer program which schedules the collection of the routine samples. For example, if the routine program calls for four milk samples every week, on a random basis each farm might provide an additional sample several times a year. These duplicate samples are analyzed along with the other routine samples. They provide information about the variability of radioactive content in the various sample media.

There is another kind of replicate sample. From time to time, if enough sample is available for a particular analysis, the laboratory analyst can split it into two portions. Such a sample can provide information about the variability of the analytical process since two identical portions of material are analyzed side by side.

Analytical knowns are another category of quality control sample. A known amount of radioactivity is added to a sample medium by the quality control staff or by the analysts themselves. The analysts are told the radioactive content of the sample. Whenever possible, the analytical knowns contain the same amount of radioactivity each time they are run. In this way, the analysts have immediate knowledge of the quality of the measurement process. A portion of these samples are also blanks.

Blind spikes are samples containing radioactivity which are introduced into the analysis process disguised as ordinary environmental samples. The analyst does not know they contain radioactivity. Since the bulk of the ordinary workload of the environmental laboratory contains no measureable activity or only naturally occurring radioisotopes, blind spikes can be used to test the detection capability of the laboratory or they can be used to test the data review process. If an analysis routinely generates numerous zeroes for a particular isotope, the presence of the isotope is brought to the attention of the laboratory supervisor in the daily review process. Blind spikes test this process since they contain radioactivity at levels high enough to be detected. Furthermore, the activity can be put into such samples at the extreme limit of detection to determine whether or not the laboratory can find any unusual radioactivity whatsoever.

At present, 5 percent of the laboratory workload is in the category of internal cross-checks. These samples have a known amount of radioactivity added and are presented to the analysts labeled as cross-check samples. This means that the quality control staff knows the radioactive content or "right answer" but the analysts do not. They are aware they are being tested. Such samples test the best performance of the laboratory by determining if the analysts can find the "right answer." These samples provide information about the accuracy of the measurement process. Further information is available about the variability of the process if multiple analyses are requested on the same sample. Internal cross-checks can also tell if there is a difference in performance between two analysts. Like blind spikes or analytical knowns, these samples can also be spiked with low levels of activity to test detection limits.

A series of cross-checks is produced by the EPA in Las Vegas. These interlaboratory comparison samples or "EPA cross-checks" are considered to be the primary indicator of laboratory performance. They provide an independent check of the entire measurement process that cannot be easily provided by the laboratory itself. That is, unlike internal cross-checks, EPA cross-checks test the calibration of the laboratory detection devices since different radioactive standards produced by individuals outside TVA are used in the cross-checks. The results of the analysis of these samples are reported back to EPA which then issues a report of all the results of all participants. These reports are examined very closely by laboratory supervisory and quality control personnel. They indicate how well the laboratory is doing compared to others across the nation. Like internal cross-checks, the EPA cross-checks provide information to the laboratory about the precision and accuracy of the radioanalytical work it does. The results of TVA's participation in the EPA Interlaboratory Comparison Program are presented in table F-1.

TVA splits certain environmental samples with laboratories operated by the States of Alabama and Tennessee and the EPA Eastern Environmental Radiation Facility in Montgomery, Alabama. When radioactivity has been present in the environment in measureable quantities, such as following atmospheric nuclear weapons testing, following the Chernobyl incident, or as naturally occurring radionuclides, the split samples have provided TVA with yet another level of information about laboratory performance.

These samples demonstrate performance on actual environmental sample matrices rather than on the constructed matrices used in cross-check programs.

All the quality control data are routinely collected, examined, and reported to laboratory supervisory personnel. They are checked for trends, problem areas, or other indications that a portion of the analytical process needs help or improvement. The end result is a measurement process that provides accurate data and is sensitive enough to measure the presence of radioactivity far below the levels which could be harmful to humans.

Table F-1

RESULTS OBTAINED IN INTERLABORATORY COMPARISON PROGRAM

A. Air Filter (pCi/Filter)

Date	Gross Alpha EPA Value (±3σ)	Gross Alpha TVA Avg.	Gross Beta EPA Value (±3σ)	Gross Beta TVA Avg.	Strontium-90 EPA Value (±3σ)	Strontium-90 TVA Avg.	Cesium-137 EPA Value (±3σ)	Cesium-137 TVA Avg.
3/89	21±9	23	62±9	65	20±2.6	a	20±9	20
8/89	6±9	9					10±9	10

B. Radiochemical Analysis of Water (pCi/L)

Date	Gross Beta EPA Value (±3σ)	Gross Beta TVA Avg.	Strontium-89 EPA Value (±3σ)	Strontium-89 TVA Avg.	Strontium-90 EPA Value (±3σ)	Strontium-90 TVA Avg.	Tritium EPA Value (±3σ)	Tritium TVA Avg.	Iodine-131 EPA Value (±3σ)	Iodine-131 TVA Avg.
1/89	4±9	2	40±9	30[b]	25±2.6	23				
2/89							2754±617	2690	106±19	98
3/89										
4/89[c]			8±9	8	8±2.6	7				
4/89										
5/89	50±9	47	6±9	<5	6±2.6	6				
6/89							4503±779	4100		
7/89										
8/89									83±14	77
9/89	6±9	9								
10/89							3496±630	3353		
10/89[c]			15±9	15	7±2.6	6				
11/89										
12/89										

Table F-1

RESULTS OBTAINED IN INTERLABORATORY COMPARISON PROGRAM (Continued)

C. Gamma-Spectral Analysis of Water (pCi/L)

Date	Barium-133 or Chromium-51 EPA Value (±3σ)	Barium-133 or Chromium-51 TVA Avg.	Cobalt-60 EPA Value (±3σ)	Cobalt-60 TVA Avg.	Zinc-65 EPA Value (±3σ)	Zinc-65 TVA Avg.	Ruthenium-106 EPA Value (±3σ)	Ruthenium-106 TVA Avg.	Cesium-134 EPA Value (±3σ)	Cesium-134 TVA Avg.	Cesium-137 EPA Value (±3σ)	Cesium-137 TVA Avg.
2/89	235±42	235	10±9	11	159±28	159	178±31	166	10±9	10	10±9	11
4/89[c]									20±9	19	20±9	20
6/89	49± 9	49	31±9	31	165±29	171	128±23	124	39±9	38	20±9	21
10/89	59±10	58	30±9	30	129±23	129	161±28	150	29±9	26	59±9	59
10/89[c]									5±9	5	5±9	6

D. Milk (pCi/L)

Date	Strontium-89 EPA Value (±3σ)	Strontium-89 TVA Avg.	Strontium-90 EPA Value (±3σ)	Strontium-90 TVA Avg.	Iodine-131 EPA Value (±3σ)	Iodine-131 TVA Avg.	Cesium-137 EPA Value (±3σ)	Cesium-137 TVA Avg.	Potassium-40[d] EPA Value (±3σ)	Potassium-40[d] TVA Avg.
4/88	39±9	24[b]	55±5	53			50±9	49	1600±139	1633

Footnotes for Table F-1

Results Obtained in Interlaboratory Comparison Program

a. Change in sample matrix resulted in lost analysis - Procedure revision in progress to accomodate mew matrix.

b. The low strontium result was investigated. A definitive cause for the low result could not be identified. Further evaluation of the strontium radioanalytical procedure continues.

c. Laboratory Performance Evaluation Study.

d. Units are milligram of total potassium per liter rather than picrocuries of K-40 per liter.

APPENDIX G

LAND USE SURVEY

Appendix G

Land Use Survey

A land use survey is conducted annually to identify the location of the nearest milk animal, the nearest residence, and the nearest garden of greater than 500 square feet producing fresh leafy vegetables in each of 16 meteorological sectors within a distance of 5 miles from the plant. The land use survey also identifies the location of all milk animals and gardens of greater than 500 square feet producing fresh leafy vegetables within a distance of 3 miles from the plant.

The land use survey is conducted between April 1 and October 1 using appropriate techniques such as door-to-door survey, mail survey, telephone survey, aerial survey, or information from local agricultural authorities or other reliable sources.

From these data, radiation doses are projected for individuals living near the plant. Doses from breathing air (air submersion) are calculated for the nearest resident in each sector, while doses from drinking milk or eating foods produced near the plant are calculated for the areas with milk producing animals and gardens, respectively. These doses are calculated using design basis source terms and historical meteorological data.

In response to the 1989 SQN land use survey, annual doses were calculated for air submersion, vegetable ingestion, and milk ingestion. The Gaseous Effluent Licensing Code was used to preform these calculations. During 1989, this code was revised to update the data used to calculate ingestion dose factors for use in the code. These revised factors resulted in some slight changes in the calculated ingestion doses.

Air submersion doses were calculated for the same locations as in 1988, with the resulting values almost identical to those calculated in 1988. Doses calculated for ingestion of home-grown foods and milk changed slightly in some sectors, reflecting the methodology changes noted above. There were no new locations with milk-producing animals identified.

Annual doses projected for 1989 were not appreciably different from those calculated for 1988. Tables G-1, G-2, and G-3 show the comparative calculated doses for 1988 and 1989.

Table G-1

SEQUOYAH NUCLEAR PLANT

Projected Annual Air Submersion Dose to the Nearest Resident
Within Five Miles of Plant
(mrem/year/reactor)

	1988 Survey		1989 Survey	
Sector	Approximate Distance (Miles)	Annual Dose	Approximate Distance (Miles)	Annual Dose
N	0.8	0.12	0.8	0.12
NNE	1.5	0.07	1.5	0.07
NE	1.4	0.07	1.4	0.07
ENE	1.3	0.03	1.3	0.03
E	1.0	0.03	1.0	0.03
ESE	1.0	0.03	1.0	0.03
SE	1.0	0.03	1.0	0.03
SSE	1.2	0.04	1.2	0.04
S	1.4	0.05	1.4	0.05
SSW	1.3	0.16	1.3	0.15
SW	1.8	0.04	1.8	0.04
WSW	0.7	0.08	0.7	0.08
W	0.6	0.08	0.6	0.08
WNW	1.1	0.02	1.1	0.02
NW	0.9	0.03	0.9	0.03
NNW	0.6	0.12	0.6	0.12

Table G-2

SEQUOYAH NUCLEAR PLANT

Projected Annual Dose to Child's Critical Organ from
Ingestion of Home-Grown Foods
(mrem/year/reactor)

Sector	1988 Survey		1989 Survey	
	Approximate Distance (Miles)	Annual Dose (Bone)	Approximate Distance (Miles)	Annual Dose (Bone)
N	1.1	2.25	1.1	2.41
NNE	1.9	1.45	1.9	1.56
NE	1.4	2.03	1.4	2.18
ENE	1.6	0.73	1.6	0.78
E	a	--	a	--
ESE	1.1	0.68	1.1	0.73
SE	2.0	0.35	2.0	0.37
SSE	1.2	1.11	1.2	1.19
S	1.5	1.53	1.5	1.64
SSW	1.7	3.05	1.7	3.27
SW	2.1	1.04	2.1	1.11
WSW	0.9	1.55	0.9	1.67
W	1.2	0.83	1.2	0.89
WNW	1.2	0.61	1.2	0.65
NW	0.9	1.10	0.9	1.18
NNW	0.6	2.88	0.6	3.08

a. No garden was identified in this sector whithin 5 miles of the plant.

Table G-3

SEQUOYAH NUCLEAR PLANT

Projected Annual Dose to Receptor Thyroid from Ingestion of Milk
(Nearest Milk Producing Animal Within Five Miles of Plant)
(mrem/year/reactor)

Location No.	Sector	Approximate Distance (Miles)[a]	Annual Dose 1988	Annual Dose 1989
Farm EM[b]	N	2.6	0.04	0.04
Farm H[c]	NE	4.2	0.02	0.02
Farm J[c]	WNW	1.1	0.03	0.03
Farm HW[c]	NW	1.2	0.05	0.06

a. Distances measured to nearest property line.
b. Vegetation sampled at this location.
c. Milk sampled at this location.

APPENDIX H

DATA TABLES

Table H-1

DIRECT RADIATION LEVELS

Average External Gamma Radiation Levels at Various Distances from
Sequoyah Nuclear Plant for Each Quarter - 1989
mR/Quarter[a]

Distance Miles	1st Quarter (Feb-Apr 89) Victoreen	1st Quarter (Feb-Apr 89) Panasonic	2nd Quarter (May-Jul 89) Victoreen	2nd Quarter (May-Jul 89) Panasonic	3rd Quarter (Aug-Oct 89) Victoreen	3rd Quarter (Aug-Oct 89) Panasonic	4th Quarter (Nov 89-Jan 90) Victoreen	4th Quarter (Nov 89-Jan 90) Panasonic
	Average External Gamma Radiation Levels[b]							
0-1	19.1 ± 2.1	15.4 ± 2.9	18.0 ± 1.8	15.1 ± 1.0	16.5 ± 1.8	17.5 ± 1.4	19.2 ± 2.3	15.6 ± 1.4
1-2	16.5 ± 2.5	13.4 ± 2.2	16.3 ± 2.1	13.3 ± 1.6	15.0 ± 2.6	15.9 ± 1.8	17.4 ± 2.5	13.6 ± 1.9
2-4	15.8 ± 2.5	12.4 ± 1.1	14.8 ± 2.7	12.4 ± 1.3	13.8 ± 3.1	15.0 ± 1.6	16.3 ± 2.1	12.9 ± 1.7
4-6	16.4 ± 2.0	13.4 ± 3.5	16.0 ± 2.9	12.6 ± 1.4	13.4 ± 2.6	15.0 ± 1.4	16.0 ± 1.8	12.8 ± 1.5
> 6	15.6 ± 2.8	12.1 ± 1.2	14.8 ± 2.7	12.6 ± 1.3	13.5 ± 2.2	14.8 ± 1.5	16.8 ± 2.6	12.7 ± 1.6
Average, 0-2 miles (onsite)	18.0 ± 2.6	14.5 ± 2.8	17.2 ± 2.1	14.3 ± 1.6	15.9 ± 2.3	16.8 ± 1.8	18.4 ± 2.5	14.7 ± 1.9
Average, greater than 2 miles (offsite)	16.0 ± 1.4	12.8 0.2.7	15.4 ± 2.8	12.6 ± 1.7	13.5 ± 2.5	14.9 ± 1.5	16.3 ± 2.1	12.8 ± 1.6

a. Data normalized to one quarter (2190 hours).
b. Averages of the individual measurements in the set ±1 standard deviation of the set.

Table H-3

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN AIR FILTER
PCI/M3 - 0.037 BQ/M3

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 615	2.00E-03	1.92E-02(410/ 410) 7.78E-03- 4.21E-02	HARRISON, TN 8.75 MILES SSW	1.88E-02(52/ 52) 9.44E-03- 3.49E-02	1.79E-02(205/ 205) 5.69E-03- 3.48E-02	
GAMMA SCAN (GELI) 156						
BE-7	2.00E-02	8.01E-02(104/ 104) 5.10E-02- 1.25E-01	LM-3 1ST TN BANK REC 1.5 MILES SSW	8.56E-02(13/ 13) 6.67E-02- 1.25E-01	7.93E-02(52/ 52) 5.61E-02- 1.24E-01	
BI-214	5.00E-03	8.24E-03(7/ 104) 5.20E-03- 1.18E-02	LM-3 1ST TN BANK REC 1.5 MILES SSW	9.20E-03(1/ 13) 9.20E-03- 9.20E-03	5.20E-03(1/ 52) 5.20E-03- 5.20E-03	
PB-214	5.00E-03	7.88E-03(5/ 104) 6.40E-03- 1.10E-02	DAISY, TN 5.5 MILES W	1.10E-02(1/ 13) 1.10E-02- 1.10E-02	52 VALUES < LLD	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-4
TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN CHARCOAL FILTER
PCI/M3 - 0.037 BQ/M3

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND* TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
IODINE-131 615	2.00E-02	2.15E-02(2/ 410) 2.05E-02- 2.24E-02	DAISY, TN 5.5 MILES W	2.24E-02(1/ 52) 2.24E-02- 2.24E-02	2.34E-02(1/ 205) 2.34E-02- 2.34E-02	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1.
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-4

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN MILK
PCI/L - 0.037 BQ/L

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
IODINE-131						
139						
	2.00E-01	74 VALUES < LLD			65 VALUES < LLD	
GAMMA SCAN (GELI)						
140						
AC-228	2.50E+01	75 VALUES < LLD	JONES FARM 1.25 MILES W	23 VALUES < LLD	3.02E+01(1/ 65) 3.02E+01- 3.02E+01	
BI-214	2.00E+01	3.20E+01(2/ 75) 2.48E+01- 3.92E+01	HOLDER DAIRY 4.25 MILES NE	3.92E+01(1/ 26) 3.92E+01- 3.92E+01	4.37E+01(7/ 65) 2.93E+01- 6.58E+01	
CS-137	5.00E+00	5.90E+00(5/ 75) 5.23E+00- 7.20E+00	H WALKER FARM 1.25 MILES NW	6.34E+00(3/ 26) 5.89E+00- 7.20E+00	65 VALUES < LLD	
K-40	1.50E+02	1.33E+03(73/ 75) 9.18E+02- 1.63E+03	HOLDER DAIRY 4.25 MILES NE	1.40E+03(26/ 26) 1.19E+03- 1.63E+03	1.29E+03(65/ 65) 4.93E+02- 1.58E+03	
PB-214	2.00E+01	75 VALUES < LLD	JONES FARM 1.25 MILES W	23 VALUES < LLD	4.53E+01(6/ 65) 2.64E+01- 7.14E+01	
SR 89						
50						
	2.50E+00	5.12E+00(1/ 11) 5.12E+00- 5.12E+00	JONES FARM 1.25 MILES W	5.12E+00(1/ 3) 5.12E+00- 5.12E+00	3.73E+00(1/ 39) 3.73E+00- 3.73E+00	
SR 90						
50						
	2.00E+00	9.48E+00(10/ 11) 2.29E+00- 2.43E+01	H WALKER FARM 1.25 MILES NW	1.30E+01(4/ 4) 3.71E+00- 2.43E+01	2.36E+00(13/ 39) 2.03E+00- 4.15E+00	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1.
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-5

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN WET VEGETATION
PCI/KG - 0.037 BQ/KG (WET WT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
IODINE-131 88	4.00E+00	4.82E+00(6/ 69) 4.02E+00- 5.86E+00	HOLDER DAIRY 4.25 MILES NE	5.86E+00(1/ 7) 5.86E+00- 5.86E+00	4.86E+00(5/ 19) 4.18E+00- 6.12E+00	
GAMMA SCAN (GELI) 89						
AC-228	8.00E+01	9.02E+01(2/ 69) 8.17E+01- 9.88E+01	EDGAR MALONE FARM 2.5 MILES N	9.88E+01(1/ 13) 9.88E+01- 9.88E+01	20 VALUES < LLD	
BE-7	2.00E+02	3.25E+03(67/ 69) 2.30E+02- 1.96E+04	LM-5 WARE POINT 1.7 MILES NNE	5.05E+03(6/ 7) 4.70E+02- 1.96E+04	2.69E+03(20/ 20) 2.64E+02- 1.46E+04	
BI-214	4.80E+01	5.12E+01(4/ 69) 4.90E+01- 5.32E+01	EDGAR MALONE FARM 2.5 MILES N	5.32E+01(1/ 13) 5.32E+01- 5.32E+01	20 VALUES < LLD	
CS-137	2.40E+01	3.62E+01(2/ 69) 3.07E+01- 4.18E+01	JONES FARM 1.25 MILES W	4.18E+01(1/ 7) 4.18E+01- 4.18E+01	20 VALUES < LLD	
K-40	4.00E+02	5.32E+03(69/ 69) 6.73E+02- 9.65E+03	LM-5 WARE POINT 1.7 MILES NNE	6.27E+03(7/ 7) 3.12E+03- 8.68E+03	5.17E+03(19/ 20) 8.47E+02- 1.06E+04	
PB-212	4.00E+01	4.67E+01(2/ 69) 4.41E+01- 4.92E+01	EDGAR MALONE FARM 2.5 MILES N	4.67E+01(2/ 13) 4.41E+01- 4.92E+01	4.22E+01(2/ 20) 4.18E+01- 4.26E+01	
SR 89 26	1.40E+02	20 VALUES < LLD			6 VALUES < LLD	
SR 90 26	6.00E+01	1.11E+02(11/ 20) 6.50E+01- 2.23E+02	H WALKER FARM 1.25 MILES NW	1.85E+02(2/ 2) 1.47E+02- 2.23E+02	6.19E+01(1/ 6) 6.19E+01- 6.19E+01	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1.
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-6

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN SOIL
PCI/GM - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT — DOCKET NO.: 50-327,328
LOCATION OF FACILITY: HAMILTON TENNESSEE — REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN: NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN: MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA SCAN (GELI) 13						
AC-228	1.00E-01	1.04E+00(8/ 8) 6.46E-01- 1.43E+00	LM-3 1ST TN BANK REC 1.5 MILES SSW	1.43E+00(1/ 1) 1.43E+00- 1.43E+00	9.00E-01(5/ 5) 6.31E-01- 1.31E+00	
BE-7	1.00E-01	1.85E-01(3/ 8) 1.33E-01- 2.52E-01	LM-5 WARE POINT 1.7 MILES NNE	2.52E-01(1/ 1) 2.52E-01- 2.52E-01	1.55E-01(3/ 5) 1.32E-01- 1.90E-01	
BI-212	2.50E-01	1.11E+00(8/ 8) 7.22E-01- 1.46E+00	LM-3 1ST TN BANK REC 1.5 MILES SSW	1.46E+00(1/ 1) 1.46E+00- 1.46E+00	8.97E-01(5/ 5) 5.76E-01- 1.24E+00	
BI-214	4.00E-02	7.62E-01(8/ 8) 3.94E-01- 9.61E-01	LM-3 1ST TN BANK REC 1.5 MILES SSW	9.61E-01(1/ 1) 9.61E-01- 9.61E-01	6.66E-01(5/ 5) 5.46E-01- 8.32E-01	
CS-137	1.00E-02	5.53E-01(8/ 8) 9.07E-02- 1.08E+00	LM-4 SKULL ISLAND 1.5 MILES NE	1.08E+00(1/ 1) 1.08E+00- 1.08E+00	2.67E-01(5/ 5) 6.55E-02- 5.73E-01	
K-40	2.00E-01	5.96E+00(8/ 8) 3.11E+00- 1.20E+01	LM2 NORTHEAST 0.75 MILES N	1.20E+01(1/ 1) 1.20E+01- 1.20E+01	6.93E+00(5/ 5) 2.42E+00- 2.04E+01	
PA-234M	3.00E+00	8 VALUES < LLD	COUNTY PARK, TN 3.75 MILES SW	1 VALUES < LLD	3.18E+00(1/ 5) 3.18E+00- 3.18E+00	
PB-212	2.00E-02	9.69E-01(8/ 8) 6.10E-01- 1.32E+00	LM-3 1ST TN BANK REC 1.5 MILES SSW	1.32E+00(1/ 1) 1.32E+00- 1.32E+00	8.41E-01(5/ 5) 6.33E-01- 1.29E+00	
PB-214	2.00E-02	8.18E-01(8/ 8) 4.34E-01- 1.02E+00	LM-3 1ST TN BANK REC 1.5 MILES SSW	1.02E+00(1/ 1) 1.02E+00- 1.02E+00	7.00E-01(5/ 5) 5.62E-01- 8.99E-01	
RA-224	3.00E-01	1.08E+00(6/ 8) 6.22E-01- 1.45E+00	LM-5 WARE POINT 1.7 MILES NNE	1.45E+00(1/ 1) 1.45E+00- 1.45E+00	8.44E-01(4/ 5) 6.79E-01- 9.53E-01	
RA-226	5.00E-02	7.62E-01(8/ 8) 3.94E-01- 9.61E-01	LM-3 1ST TN BANK REC 1.5 MILES SSW	9.61E-01(1/ 1) 9.61E-01- 9.61E-01	6.66E-01(5/ 5) 5.46E-01- 8.32E-01	
TL-208	2.00E-02	3.30E-01(8/ 8) 2.03E-01- 4.52E-01	LM-3 1ST TN BANK REC 1.5 MILES SSW	4.52E-01(1/ 1) 4.52E-01- 4.52E-01	2.84E-01(5/ 5) 2.25E-01- 4.15E-01	
SR 89 13	1.00E+00	8 VALUES < LLD			5 VALUES < LLD	
SR 90 13	3.00[illegible]	3.21E-01(1/ 8) 3.21E-01- 3.21E-01	LM-4 SKULL ISLAND 1.5 MILES NE	3.21E-01(1/ 1) 3.21E-01- 3.21E-01	5 VALUES < LLD	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F)

Table H-7
TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN APPLES
PCI/KG - 0.037 BQ/KG (WET WT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	9.00E+00	1.54E+03(1/ 1) 1.54E+03- 1.54E+03	H WALKER FARM 1.25 MILES NW	1.54E+03(1/ 1) 1.54E+03- 1.54E+03	1.50E+03(1/ 1) 1.50E+03- 1.50E+03	
GAMMA SCAN (GELI) 2						
K-40	1.50E+02	9.17E+02(1/ 1) 9.17E+02- 9.17E+02	H WALKER FARM 1.25 MILES NW	9.17E+02(1/ 1) 9.17E+02- 9.17E+02	6.86E+02(1/ 1) 6.86E+02- 6.86E+02	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F)

Table H-8

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN CABBAGE
PCI/KG - 0.037 BQ/KG (WET WT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	9.00E+00	2.87E+03(1/ 1) 2.87E+03- 2.87E+03	H WALKER FARM 1.25 MILES NW	2.87E+03(1/ 1) 2.87E+03- 2.87E+03	2.41E+03(1/ 1) 2.41E+03- 2.41E+03	
GAMMA SCAN (GELI) 2						
K-40	1.50E+02	1.66E+03(1/ 1) 1.66E+03- 1.66E+03	H WALKER FARM 1.25 MILES NW	1.66E+03(1/ 1) 1.66E+03- 1.66E+03	1.27E+03(1/ 1) 1.27E+03- 1.27E+03	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F)

Table H-9
TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN CORN
PCI/KG - 0.037 BQ/KG (WET WT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE
DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	9.00E+00	4.49E+03(1/ 1) 4.49E+03- 4.49E+03	H WALKER FARM 1.25 MILES NW	4.49E+03(1/ 1) 4.49E+03- 4.49E+03	3.51E+03(1/ 1) 3.51E+03- 3.51E+03	
GAMMA SCAN (GELI) 2						
K-40	1.50E+02	2.46E+03(1/ 1) 2.46E+03- 2.46E+03	H WALKER FARM 1.25 MILES NW	2.46E+03(1/ 1) 2.46E+03- 2.46E+03	1.98E+03(1/ 1) 1.98E+03- 1.98E+03	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-10

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN GREEN BEANS
PCI/KG - 0.037 BQ/KG (WET WT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	9.00E+00	5.17E+03(1/ 1) 5.17E+03- 5.17E+03	H WALKER FARM 1.25 MILES NW	5.17E+03(1/ 1) 5.17E+03- 5.17E+03	2.92E+03(1/ 1) 2.92E+03- 2.92E+03	
GAMMA SCAN (GELI) 2						
K-40	1.50E+02	2.65E+03(1/ 1) 2.65E+03- 2.65E+03	H WALKER FARM 1.25 MILES NW	2.65E+03(1/ 1) 2.65E+03- 2.65E+03	1.87E+03(1/ 1) 1.87E+03- 1.87E+03	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1.
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-11

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN POTATOES
PCI/KG - 0.037 BQ/KG (WET WT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	9.00E+00	4.76E+03(1/ 1) 4.76E+03- 4.76E+03	H WALKER FARM 1.25 MILES NW	4.76E+03(1/ 1) 4.76E+03- 4.76E+03	5.76E+03(1/ 1) 5.76E+03- 5.76E+03	
GAMMA SCAN (GELI) 2						
CS-137	5.00E+00	7.62E+00(1/ 1) 7.62E+00- 7.62E+00	H WALKER FARM 1.25 MILES NW	7.62E+00(1/ 1) 7.62E+00- 7.62E+00	1 VALUES < LLD	
K-40	1.50E+02	2.56E+03(1/ 1) 2.56E+03- 2.56E+03	H WALKER FARM 1.25 MILES NW	2.56E+03(1/ 1) 2.56E+03- 2.56E+03	3.50E+03(1/ 1) 3.50E+03- 3.50E+03	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-12

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN TOMATOES
PCI/KG - 0.037 BQ/KG (WET WT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT — DOCKET NO.: 50-327,328
LOCATION OF FACILITY: HAMILTON TENNESSEE — REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 2	9.00E+00	4.14E+03(1/ 1) 4.14E+03- 4.14E+03	H WALKER FARM 1.25 MILES NW	4.14E+03(1/ 1) 4.14E+03- 4.14E+03	3.50E+03(1/ 1) 3.50E+03- 3.50E+03	
GAMMA SCAN (GELI) 2						
K-40	1.50E+02	2.71E+03(1/ 1) 2.71E+03- 2.71E+03	H WALKER FARM 1.25 MILES NW	2.71E+03(1/ 1) 2.71E+03- 2.71E+03	1.77E+03(1/ 1) 1.77E+03- 1.77E+03	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1.
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-13
TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT.
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN SURFACE WATER(Total)
PCI/L - 0.037 BQ/L

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 39	1.70E+00	2.55E+00(24/ 26) 1.77E+00- 4.00E+00	TRM 473.2	2.66E+00(12/ 13) 2.06E+00- 4.00E+00	2.72E+00(11/ 13) 2.05E+00- 3.25E+00	
GAMMA SCAN (GELI) 39						
PB-214	2.00E+01	2.22E+01(1/ 26) 2.22E+01- 2.22E+01	TRM 483.4	2.22E+01(1/ 13) 2.22E+01- 2.22E+01	13 VALUES < LLD	
SR 89 12	3.00E+00	5.24E+00(2/ 8) 4.49E+00- 6.00E+00	TRM 483.4	6.00E+00(1/ 4) 6.00E+00- 6.00E+00	3.17E+00(1/ 4) 3.17E+00- 3.17E+00	
SR 90 12	1.40E+00	8 VALUES < LLD			4 VALUES < LLD	
TRITIUM 12	2.50E+02	8 VALUES < LLD			4 VALUES < LLD	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-14
TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN PUBLIC WATER(Total)
PCI/L - 0.037 BQ/L

NAME OF FACILITY SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY HAMILTON TENNESSEE

DOCKET NO. 50-327,328
REPORTING PERIOD 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 62	1.70E+00	2.43E+00(26/ 37) 1.75E+00- 3.69E+00	CF INDUSTRIES TRM 473.0	2.53E+00(12/ 12) 1.75E+00- 3.25E+00	2.81E+00(23/ 25) 2.05E+00- 3.93E+00	
IODINE-131 26	1.00E+00	13 VALUES < LLD			13 VALUES < LLD	
GAMMA SCAN (GELI) 64						
BI-214	2.00E+01	2.18E+01(1/ 38) 2.18E+01- 2.18E+01	E.I. DUPONT TRM 470.5	2.18E+01(1/ 13) 2.18E+01- 2.18E+01	3.08E+01(1/ 26) 3.08E+01- 3.08E+01	
PB-214	2.00E+01	3.09E+01(1/ 38) 3.09E+01- 3.09E+01	CHICKAMAUGA DAM TRM 465.3	3.09E+01(1/ 12) 3.09E+01- 3.09E+01	26 VALUES < LLD	
SR 89 19	3.00E+00	3.90E+00(1/ 11) 3.90E+00- 3.90E+00	CF INDUSTRIES TRM 473.0	3.90E+00(1/ 4) 3.90E+00- 3.90E+00	3.17E+00(1/ 8) 3.17E+00- 3.17E+00	
SR 90 19	1.40E+00	11 VALUES < LLD			8 VALUES < LLD	
TRITIUM 19	2.50E+02	11 VALUES < LLD			8 VALUES < LLD	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-14

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT.
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN WELL WATER(Total)
PCI/L - 0.037 BQ/L

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GROSS BETA 8	1.70E+00	3.33E+00(4/ 4) 2.25E+00- 4.41E+00	SQN WELL #6 ONSITE NNE	3.33E+00(4/ 4) 2.25E+00- 4.41E+00	5.37E+00(4/ 4) 2.02E+00- 8.28E+00	
GAMMA SCAN (GELI) 8						
BI-214	2.00E+01	4 VALUES < LLD	SQN WELL #6 ONSITE NNE	4 VALUES < LLD	1.59E+02(4/ 4) 2.53E+01- 2.85E+02	
TRITIUM 8	2.50E+02	3.79E+02(1/ 4) 3.79E+02- 3.79E+02	SQN WELL #6 ONSITE NNE	3.79E+02(1/ 4) 3.79E+02- 3.79E+02	4 VALUES < LLD	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1.
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-16

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT.
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN FISH-FLESH-CC
PCI/GM - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT — DOCKET NO.: 50-327,328
LOCATION OF FACILITY: HAMILTON TENNESSEE — REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA SCAN (GELI) 6						
CS-137	6.00E-02	4 VALUES < LLD	NICKAJACK RES TRM 425-471	2 VALUES < LLD	7.59E-02(2/ 2) 6.48E-02- 8.70E-02	
K-40	1.00E+00	1.05E+01(4/ 4) 9.83E+00- 1.11E+01	NICKAJACK RES TRM 425-471	1.08E+01(2/ 2) 1.04E+01- 1.11E+01	1.10E+01(2/ 2) 1.06E+01- 1.14E+01	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1.
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-17
TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN FISH-FLESH-WC
PCI/GM - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA SCAN (GELI) 6						
CS-137	6.00E-02	1.04E-01(1/ 4) 1.04E-01- 1.04E-01	NICKAJACK RES TRM 425-471	1.04E-01(1/ 2) 1.04E-01- 1.04E-01	1.43E-01(2/ 2) 7.94E-02- 2.06E-01	
K-40	1.00E+00	1.16E+01(4/ 4) 6.40E+00- 1.67E+01	CHICKAMAUGA RES TRM 471-530	1.20E+01(2/ 2) 7.34E+00- 1.67E+01	1.67E+01(2/ 2) 1.63E+01- 1.72E+01	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-18

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN FISH-FLESH-SB
PCI/GM - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO. 50-327,328
REPORTING PERIOD 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA SCAN (GELI) 6						
K-40	1.00E+00	8.52E+00(4/ 4) 6.78E+00- 1.19E+01	NICKAJACK RES TRM 425-471	9.33E+00(2/ 2) 6.78E+00- 1.19E+01	9.80E+00(2/ 2) 7.07E+00- 1.25E+01	

NOTE: 1 NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2 MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-19

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN FISH-WHOLE-SB
PCI/GM - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA SCAN (GELI) 6						
K-40	1.00E+00	5.50E+00(4/ 4) 3.98E+00- 9.26E+00	NICKAJACK RES TRM 425-471	6.95E+00(2/ 2) 4.64E+00- 9.26E+00	5.76E+00(2/ 2) 4.45E+00- 7.07E+00	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-20

TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN SEDIMENT
PCI/GM - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT — DOCKET NO: 50-327,328
LOCATION OF FACILITY: HAMILTON TENNESSEE — REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA SCAN (GELI) 8						
AC-228	1.00E-01	1.19E+00(6/ 6) 5.70E-01- 1.56E+00	TRM 480.82	1.51E+00(2/ 2) 1.46E+00- 1.56E+00	1.23E+00(2/ 2) 1.20E+00- 1.26E+00	
BI-212	2.50E-01	1.19E+00(6/ 6) 5.83E-01- 1.62E+00	TRM 480.82	1.50E+00(2/ 2) 1.38E+00- 1.62E+00	1.29E+00(2/ 2) 1.20E+00- 1.38E+00	
BI-214	4.00E-02	9.24E-01(6/ 6) 5.06E-01- 1.45E+00	TRM 480.82	1.17E+00(2/ 2) 8.92E-01- 1.45E+00	8.41E-01(2/ 2) 7.49E-01- 9.32E-01	
CO-60	1.00E-02	9.81E-02(5/ 6) 1.41E-02- 1.99E-01	TRM 480.82	1.75E-01(2/ 2) 1.52E-01- 1.99E-01	5.20E-02(2/ 2) 4.30E-02- 6.09E-02	
CS-137	1.00E-02	9.07E-01(6/ 6) 4.09E-02- 2.27E+00	TRM 480.82	2.18E+00(2/ 2) 2.09E+00- 2.27E+00	9.70E-01(2/ 2) 9.57E-01- 9.83E-01	
K-40	2.00E-01	1.36E+01(6/ 6) 6.31E+00- 1.68E+01	TRM 480.82	1.60E+01(2/ 2) 1.55E+01- 1.66E+01	1.34E+01(2/ 2) 1.31E+01- 1.37E+01	
PA-234M	3.00E+00	3.47E+00(1/ 6) 3.47E+00- 3.47E+00	TRM 483.4	3.47E+00(1/ 2) 3.47E+00- 3.47E+00	2 VALUES < LLD	
PB-212	2.00E-02	1.13E+00(6/ 6) 5.30E-01- 1.63E+00	TRM 480.82	1.48E+00(2/ 2) 1.33E+00- 1.63E+00	1.14E+00(2/ 2) 1.09E+00- 1.19E+00	
PB-214	2.00E-02	9.88E-01(6/ 6) 5.51E-01- 1.57E+00	TRM 480.82	1.27E+00(2/ 2) 9.63E-01- 1.57E+00	9.04E-01(2/ 2) 8.25E-01- 9.84E-01	
RA-224	3.00E-01	1.20E+00(5/ 6) 6.11E-01- 1.84E+00	TRM 480.82	1.84E+00(1/ 2) 1.84E+00- 1.84E+00	1.15E+00(1/ 2) 1.15E+00- 1.15E+00	
RA-226	5.00E-02	9.24E-01(6/ 6) 5.06E-01- 1.45E+00	TRM 480.82	1.17E+00(2/ 2) 8.92E-01- 1.45E+00	8.41E-01(2/ 2) 7.49E-01- 9.32E-01	
TL-208	2.00E-02	3.83E-01(6/ 6) 1.78E-01- 5.46E-01	TRM 480.82	4.92E-01(2/ 2) 4.39E-01- 5.46E-01	3.89E-01(2/ 2) 3.75E-01- 4.03E-01	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-21
TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN SHORELINE SEDIMENT
PCI/GM - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT — DOCKET NO.: 50-327,328
LOCATION OF FACILITY: HAMILTON TENNESSEE — REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN: NAME DISTANCE AND DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN: MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA SCAN (GELI) 6						
AC-228	1.00E-01	1.00E+00(4/ 4) 5.98E-01- 1.64E+00	GOLD POINT TRM 478	1.12E+00(2/ 2) 5.98E-01- 1.64E+00	7.41E-01(2/ 2) 2.95E-01- 1.19E+00	
BE-7	1.00E-01	1.94E-01(2/ 4) 1.61E-01- 2.27E-01	GOLD POINT TRM 478	2.27E-01(1/ 2) 2.27E-01- 2.27E-01	2 VALUES < LLD	
BI-212	2.50E-01	1.03E+00(4/ 4) 5.81E-01- 1.72E+00	GOLD POINT TRM 478	1.15E+00(2/ 2) 5.81E-01- 1.72E+00	7.63E-01(2/ 2) 3.15E-01- 1.21E+00	
BI-214	4.00E-02	8.74E-01(4/ 4) 4.42E-01- 1.24E+00	HARRISON FLATS TRM 477	9.06E-01(2/ 2) 8.02E-01- 1.01E+00	5.79E-01(2/ 2) 2.64E-01- 8.94E-01	
CO-60	1.00E-02	2.39E-02(2/ 4) 1.41E-02- 3.38E-02	GOLD POINT TRM 478	3.38E-02(1/ 2) 3.38E-02- 3.38E-02	2 VALUES < LLD	
CS-137	1.00E-02	7.04E-02(4/ 4) 3.07E-02- 1.06E-01	GOLD POINT TRM 478	7.23E-02(2/ 2) 4.49E-02- 9.98E-02	1.78E-02(1/ 2) 1.78E-02- 1.78F-02	
K-40	2.00E-01	5.34E+00(4/ 4) 2.01E+00- 8.24E+00	HARRISON FLATS TRM 477	5.56E+00(2/ 2) 5.27E+00- 5.86E+00	5.16E+00(2/ 2) 3.63E+00- 6.69E+00	
PB-212	2.00E-02	9.26E-01(4/ 4) 5.15E-01- 1.51E+00	GOLD POINT TRM 478	1.01E+00(2/ 2) 5.15E-01- 1.51E+00	6.87E-01(2/ 2) 2.89E-01- 1.08E+00	
PB-214	2.00E-02	9.38E-01(4/ 4) 4.65E-01- 1.34E+00	HARRISON FLATS TRM 477	9.74E-01(2/ 2) 8.85E-01- 1.06E+00	6.05E-01(2/ 2) 2.78E-01- 9.[illegible]E-01	
RA-224	3.00E-01	9.80E-01(2/ 4) 4.60E-01- 1.50E+00	GOLD POINT TRM 478	9.80E-01(2/ 2) 4.60E-01- 1.50E+00	8.57E-01(2/ 2) 3.79E-01- 1.34E+00	
RA-226	5.00E-02	8.74E-01(4/ 4) 4.42E-01- 1.24E+00	HARRISON FLATS TRM 477	9.06E-01(2/ 2) 8.02E-01- 1.01E+00	5.79E-01(2/ 2) 2.64E-01- 8.94E-01	
TL-208	2.00E-02	3.20E-01(4/ 4) 1.83E-01- 5.35E-01	GOLD POINT TRM 478	3.59E-01(2/ 2) 1.83E-01- 5.35E-01	2.50E-01(2/ 2) 9.39E-02- 4.06E-01	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Table H-22
TENNESSEE VALLEY AUTHORITY
RADIOLOGICAL CONTROL
ENVIRONMENTAL RADIOLOGICAL MONITORING AND INSTRUMENTATION DEPT
WESTERN AREA RADIOLOGICAL LABORATORY
ENVIRONMENTAL MONITORING REPORTING SYSTEM
RADIOACTIVITY IN CLAM FLESH
PCI/GM - 0.037 BQ/G (DRY WEIGHT)

NAME OF FACILITY: SEQUOYAH NUCLEAR PLANT
LOCATION OF FACILITY: HAMILTON TENNESSEE

DOCKET NO.: 50-327,328
REPORTING PERIOD: 1989

TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD) SEE NOTE 1	ALL INDICATOR LOCATIONS MEAN (F) RANGE SEE NOTE 2	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE AND DIRECTION	MEAN (F) RANGE SEE NOTE 2	CONTROL LOCATIONS MEAN (F) RANGE SEE NOTE 2	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
GAMMA SCAN (GELI) 1						
	NOT ESTAB	1 VALUES < LLD			0 VALUES < LLD	

NOTE: 1. NOMINAL LOWER LIMIT OF DETECTION (LLD) AS DESCRIBED IN TABLE E-1.
NOTE: 2. MEAN AND RANGE BASED UPON DETECTABLE MEASUREMENTS ONLY. FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F).

Figure H-1

Direct Radiation Levels
Sequoyah Nuclear Plant

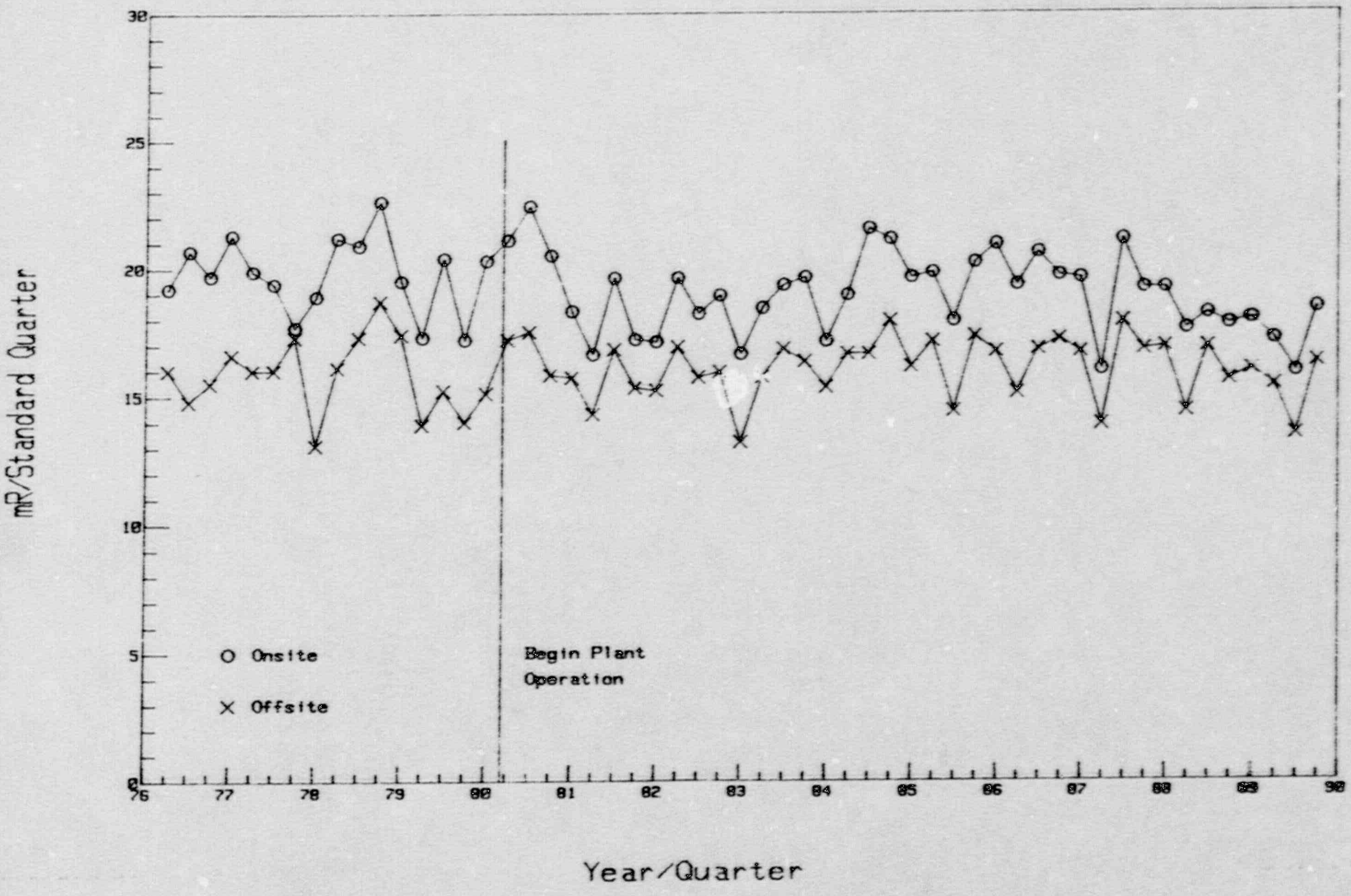
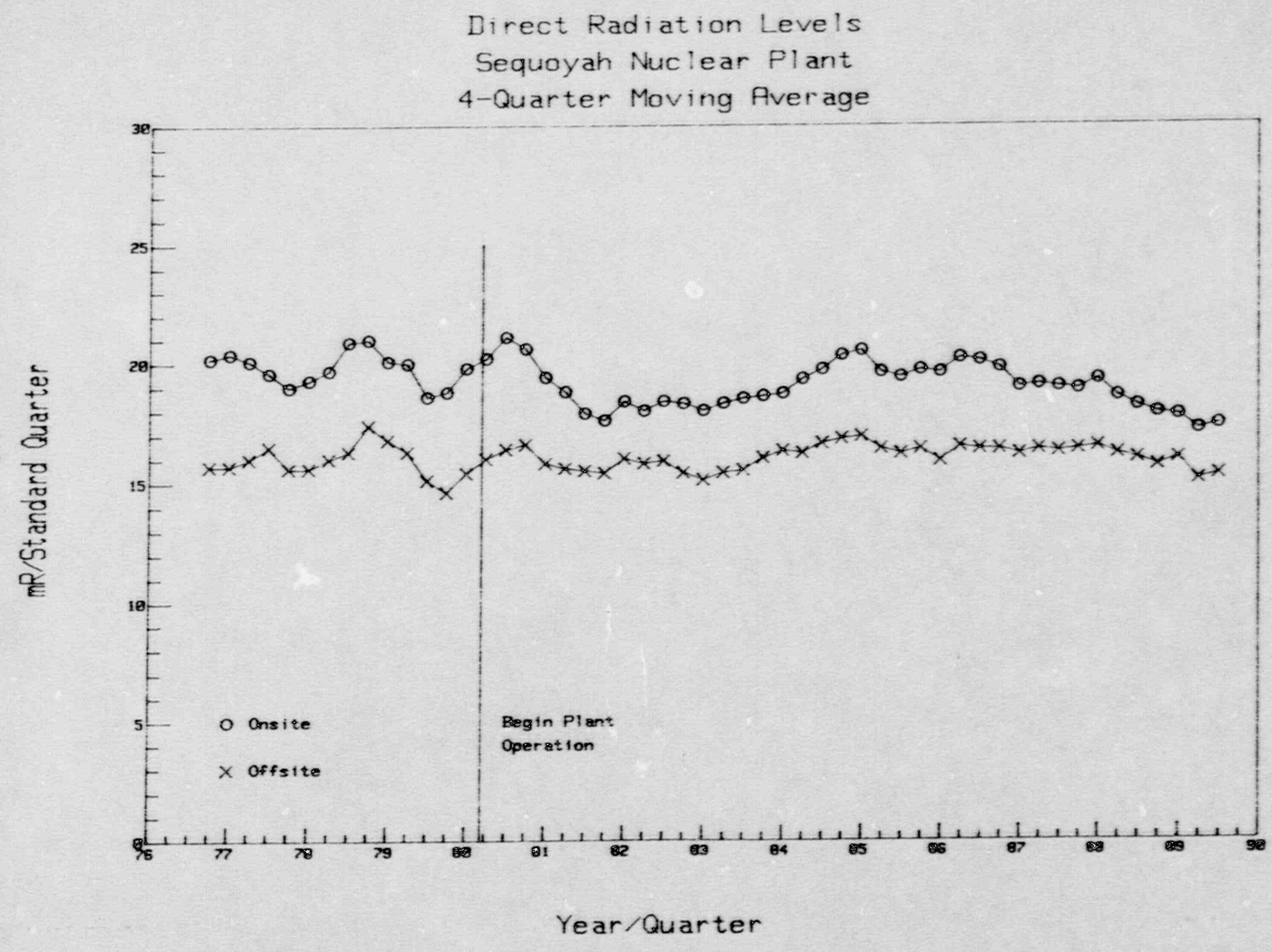


Figure H-2



Direct Radiation Levels
Sequoyah Nuclear Plant
4-Quarter Moving Average
mR/Standard Quarter
30
25
20
15
10
5
0
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
Year/Quarter
O Onsite
X Offsite
Begin Plant
Operation

Figure H-3

Annual Average Gross Beta Activity
Air Filters (pCi/Cubic Meter)
Sequoyah Nuclear Plant

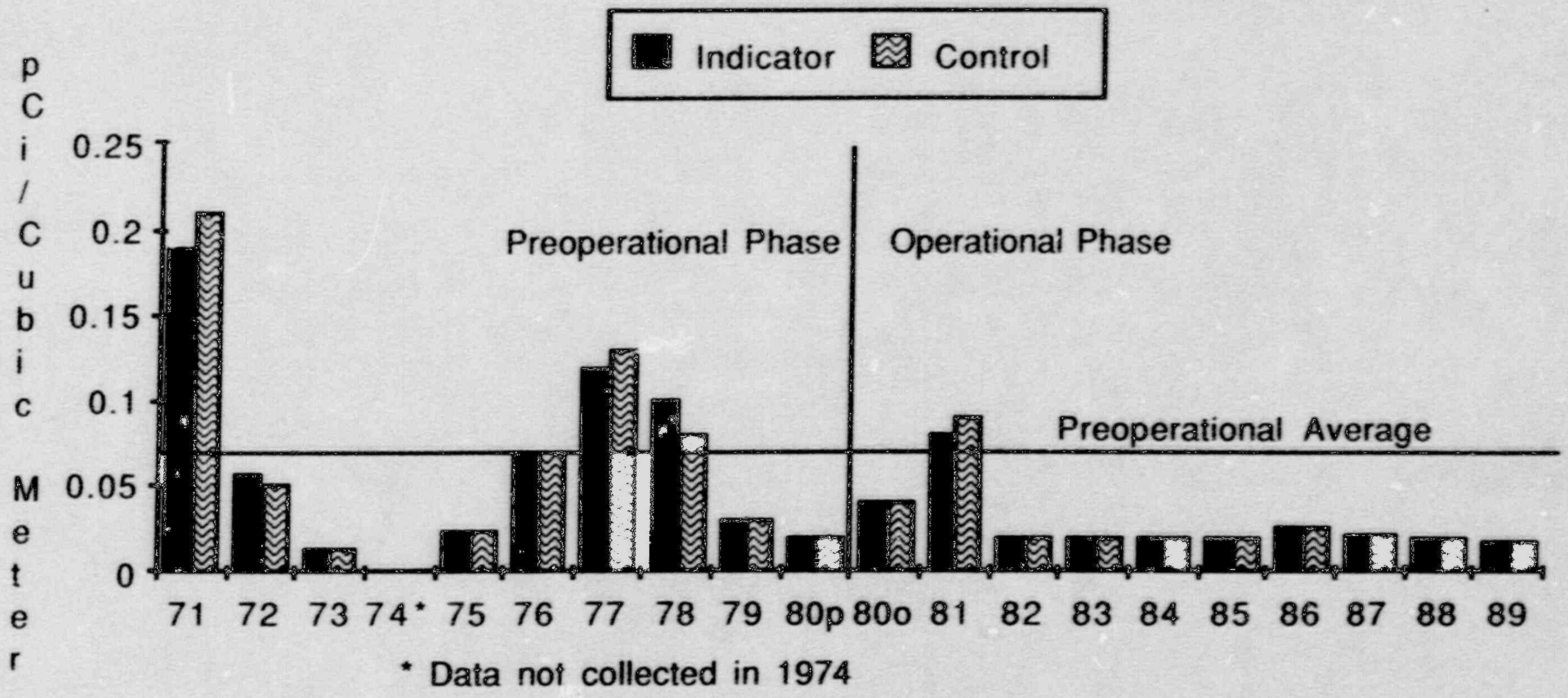


Figure H-4

Annual Average Gross Beta Activity
Surface Water (pCi/liter)
Sequoyah Nuclear Plant

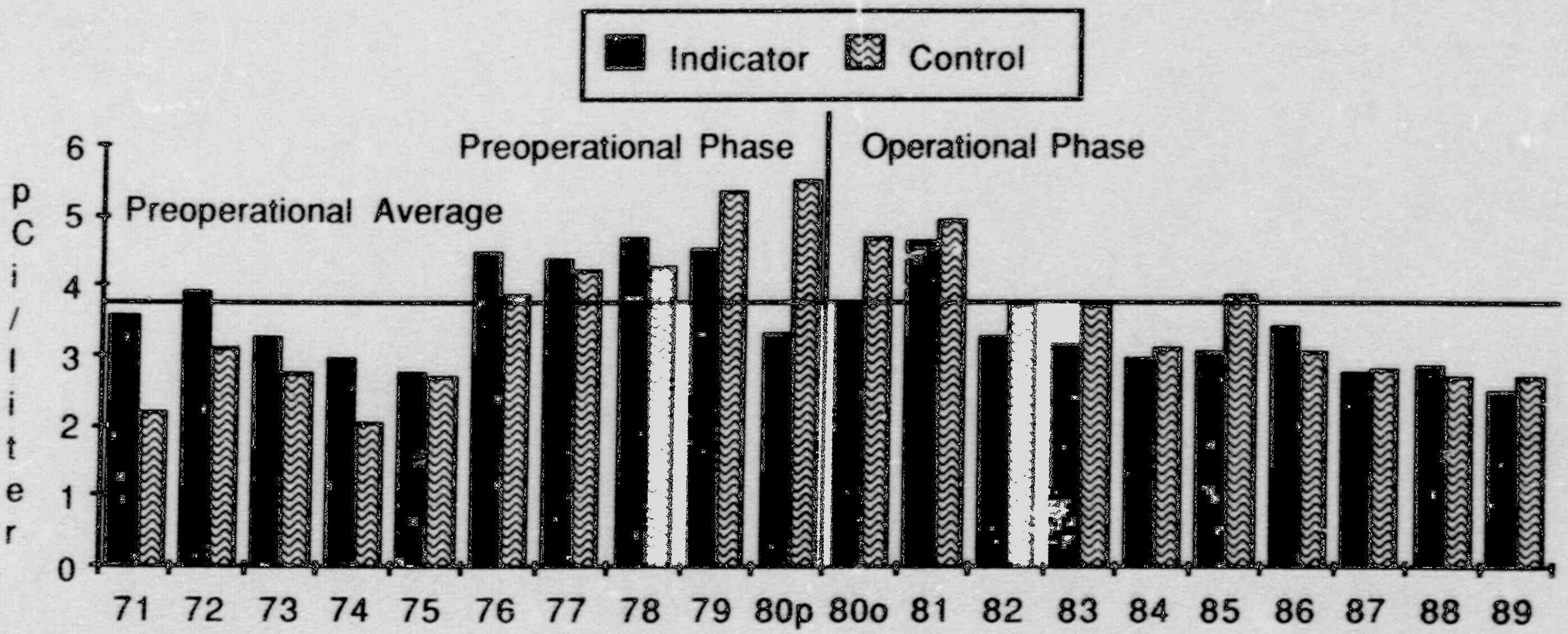


Figure H-5

Annual Average Gross Beta Activity
Drinking Water (pCi/liter)
Sequoyah Nuclear Plant